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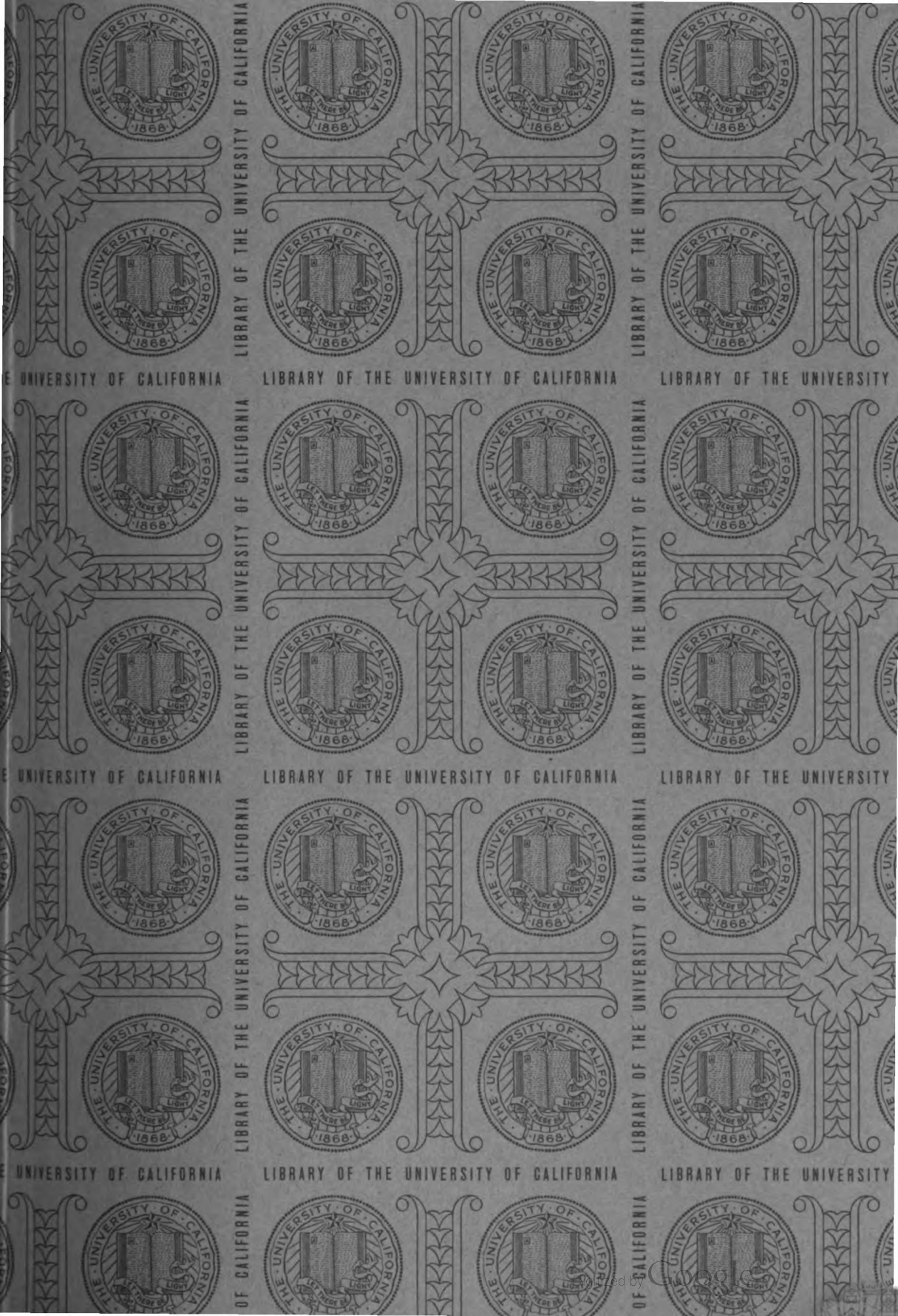


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ASSISTANT EDITOR :

LIEUTENANT-COLONEL J. C. BARNETSON, *O.B.E.*, R.A.M.C.

MANAGER :

MAJOR W. R. WEST-WATSON, *M.B.E.*, R.A.M.C.

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THE EOSINOPHILIC RESPIRATORY SYNDROME A Review of 100 Cases

BY

Major E. SOYSA, O.B.E., M.B.Lond., M.R.C.P.Edin.

*Ceylon Medical Corps ; Medical Specialist, Ceylon Army Command (1942-1946) ;
Physician, British Military Hospital, Colombo, Ceylon.*

INCREASING interest has recently arisen in a bronchopulmonary syndrome characterized by spasmodic bronchitis and asthma associated with distinctive hæmatological disturbances, remarkable radiological changes in the lungs, and a specific response to arsenic. This symptom-complex has acquired a variety of names : "eosinophilic bronchitis" (Lottrup, 1936), "pseudotuberculosis of the lungs" (Frimödt-Möller and Barton, 1940), "lecithinophile eosinophilia" (Greval, 1940), "intrinsic asthma" (Alexander, 1941), "tropical eosinophilia" (Weingarten, 1943), "benign eosinophile leukæmia" (Simmeons, 1943), "eosinophilic lung" (Chaudhuri, 1943). The notions implied in these designations bear allusion to the salient features of this syndrome—the dominant eosinophilic leucocytosis, the presenting respiratory symptoms, the simulation of pulmonary tuberculosis, the benign course and the tropical incidence of the malady. Most of those who have been affected have been inhabitants of the tropics, chiefly India and Ceylon, but the syndrome has been observed in East Africa (Ritchie, 1944), Egypt (Parsons-Smith, 1944), Samoa (Hirst and McCann, 1945), Havana (Bass, 1945), and other lands. A few transients have exhibited symptoms after return from tropical to temperate zones (Emerson, 1944; Apley and Grant, 1944; Hunter, 1946), while the syndrome has been reported even in persons who had never left America (Scherlis, 1945) and Europe (Hall, 1946).

The association of this disease with mite infestation of the lungs or bronchi was first suggested by workers in Ceylon (Carter, Wedd, and D'Abrera, 1944). Their discovery that mites were expectorated in the sputum of patients suffering from asthma and massive eosinophilia was independently confirmed in Ceylon,

while evidence was adduced to indicate the ætiological significance of exposure to a mite-laden atmosphere (Soysa and Jayawardena, 1945). The postulated connexion between eosinophilic respiratory disorders and pulmonary acariasis has received further support in Ceylon (Carter and D'Abrera, 1946a ; D'Abrera, 1946a), the Netherlands West Indies (Van der Saar, 1946), England (Hall, 1946), Spain (Figueroa Taboada, 1946), and East Africa (Wilson, 1947).

Acariasis has been closely studied in its various aspects in animals, but the pathogenic roles of mites in human pathology has been investigated mainly in relation to cutaneous acariasis, e.g. itch due to *Sarcoptes scabiei*, and occupational dermatoses due to various acarine infestations among workers in grocery shops, grain mills, tea stores, copra kilns, sugar-cane presses, pineapple plantations, dockyards, etc.

Relatively less attention seems to have been paid to visceral acariasis in man. Gastro-intestinal disorders have been traced to allergic and toxic effects of mites in stored food products (Hase, 1929) ; live mites and eggs have been recovered from the fæces in diarrhœa due to over-ripe cheese (Manson-Bahr and Muggleton, 1945). Mites have been detected in the bladder by cystoscopy (Carnegie Dickson, 1921), and have been found breeding in colonies in a scrotal cyst (Hinman and Kampmeier, 1934), and in a cancerous jaw (Simpson, 1944).

Though it is only recently that pulmonary acariasis has claimed attention among mite infestations of man, it has not escaped attention in the past. Thirty-five years ago Tyroglyphid mites were detected in the sputum of a lung abscess patient who had never been out of England (Fisher, 1946). The asthmogenic agency of mites had been suspected some two decades ago in grain mill workers in Italy (Ancona, 1923), and among persons hypersensitive to house dust in Holland (Van Leeuwen, 1929).

The following review of 100 cases of this eosinophilic respiratory syndrome is presented as a further contribution towards the quest to produce a solution to the problem which the facts exhibit.

SYMPTOMATOLOGY

A progressive three-stage clinical course was discernible in the majority (70 per cent) of cases in this investigation, and a fairly typical and consistent clinical history was elicited from these patients :

The initial, or prodromal, stage appeared with malaise, feverishness, and anorexia, insidiously progressing to a febrile coryza accompanied by an occasional dry cough. This phase lasted from a week to a month.

The intermediate, or bronchitic, stage announced its onset with low fever and increasing frequency, persistence, and intensity of the cough, which was commonly described as irritating, hacking, or dry. Many patients emphasized the loss of sleep caused by nocturnal paroxysms of coughing, with consequent weariness, exhaustion, and asthenia. The presenting clinical signs were those of nonproductive bronchitis with irregular, low, evening fever seldom rising above 100° F., and occasional slight enlargement of the spleen. When crepitant râles occur with such a temperature an erroneous suspicion of pulmonary tuberculosis may arise, particularly if the radiological appearances of the lungs be misinterpreted.

The duration of this stage varied from one month to three years. When

prolonged beyond three or four months, there sometimes was a history of irregular remission and recrudescence of cough and fever, but most patients gradually became free of fever and continued to suffer from spasmodic bronchitis.

The terminal, or asthmatic, stage was the most prominent clinical phase, affecting all but 3 patients in this series. In 70 per cent of the cases expiratory dyspnoea supervened on the bronchitis. In 25 per cent the illness started with asthma, sometimes with a sudden explosive onset. A bronchopneumonic interlude between the bronchitic and asthmatic stages was observed in 2 cases (Cases 54 and 94). Cough was unproductive in about 15 per cent of the cases, while copious expectoration was rare. The sputum was usually scanty and mucoid, and expectorated in ropy, tenacious form, or as thick, viscid pellets. Fever and enlargement of the spleen were less evident than in the preceding stage, and the temperature neither rose high nor remained elevated for long. Lymphadenopathy, cutaneous and alimentary disturbance observed by others (Patel, 1945; Joseph, 1946) were not evident in these patients.

This stage varied in duration between the limits of one week (Case 94, fig. 7) and thirteen years (Case 98), and included both acute and chronic types of the syndrome. Status asthmaticus developed in 5 patients, 3 of whom were under arsenical treatment. Several patients with distressing nocturnal paroxysms were comparatively free from discomfort by day. Impairment of general health, commonly ascribed to loss of sleep with lassitude and malaise in the mornings, anorexia and loss of weight, had induced debilitation in about 25 per cent of the patients. In many of these progressive diminution of respiratory efficiency from long-standing bronchitis and asthma had contributed to asthenia. Most patients who had been afflicted for over a year stated that relapses had become less frequent and less severe with longer remissions. About 15 per cent of the patients had reached this chronic stage. To many of them what once had seemed a symptom of grave concern had dwindled to a trivial complaint, and they had adjusted themselves to occasional mild respiratory embarrassment, suffering no further constitutional ill-effects—an indication of the benign nature of the malady.

Conflicting observations that have arisen about splenic signs in this syndrome now seem possible of reconciliation. The spleen was palpable in 17 per cent of the patients in this investigation, of whom 12 were febrile cases—5 during the bronchitic stage only, 2 during the asthmatic stage only, 5 during both stages. Of the 5 afebrile patients with palpable spleens, 3 had a malarial history, 1 of these being found with a benign tertian parasitaemia. These observations suggest that the spleen may become temporarily enlarged during febrile phases of the syndrome, but rarely in the absence of fever. In most of these patients the spleen was only just palpable, and in no case had it extended beyond two fingerbreadths below the costal margin; it was invariably smooth and firm, rarely tender to palpation, and never subjectively painful.

RADIOLOGY

Certain pulmonary radiological appearances have come to be recognized as pathognomonic of this syndrome, and have acquired such picturesque designations as “ground glass haze,” “snowstorm picture,” and “eosinophilic lung pattern.” Synthesis of the radiological features which comprise these appearances helps to differentiate the condition from tuberculosis, pneumoconiosis, and other conditions :

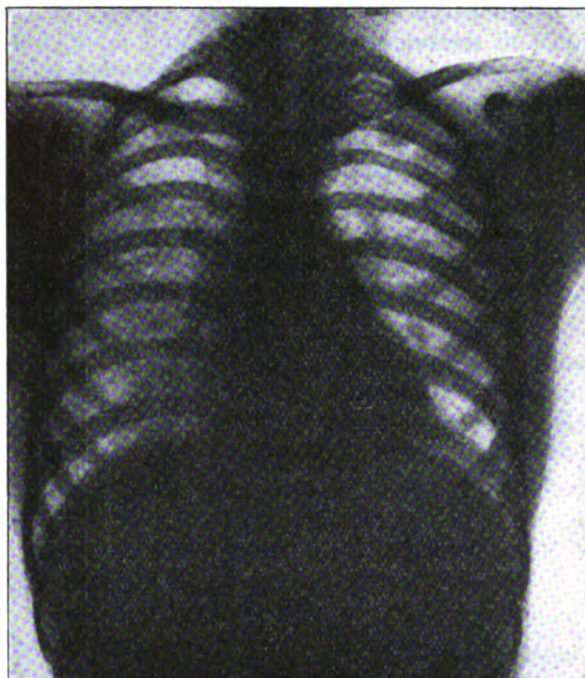


FIG. 1 (*Case 1*).—Skiagram illustrating the “eosinophilic lung picture.”

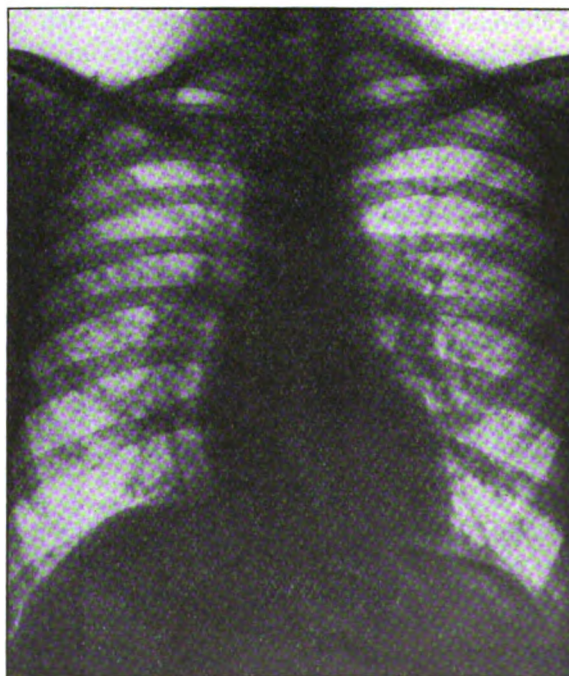


FIG. 2 (*Case 21*).—Skiagram illustrating the “eosinophilic lung picture.”

The widespread accentuation of the finer lung markings, resulting in a uniform and symmetrical distribution of fine, linear striations throughout both lung fields is more suggestive of a diffuse catarrhal reaction of the lesser bronchi and bronchioles, rather than of tuberculous infiltration, which may be expected to be more localized.

The diffuse, bilateral spotting of the lung fields with minute, ill-defined, discrete nodal opacities, producing a remarkable mottling that may suggest miliary dissemination of tubercles, can be distinguished from the latter by its even and symmetrical distribution and by the smaller size and less clear definition of its spots.

The diffuse, persistent, fibrotic changes of pneumokoniosis are devoid of spotting or mottling, and should not be confused with the radiological picture of this syndrome.

The nodal shadows in this condition have been hypothetically ascribed to various possibilities: bronchopneumonic infiltrations of pulmonary alveoli (Weingarten, 1943); aggregations of large-granuled eosinophils (Chaudhuri, 1943); focal lesions caused by encapsulation of mites (Davis, 1945). Whatever be the explanation of these radiological changes, the fact is established that they are neither progressive nor irreversible, that they are distinct from the transient pulmonary infiltrations described by Löffler (1932), and that they are eliminated by arsenical therapy.

More than 50 per cent of the skiagrams examined showed these appearances, which were generally distributed evenly and symmetrically throughout both lung fields (fig. 1). In some cases the changes were more prominent in the hilar zones, where the usual hilar shadows often showed accentuated density (fig. 2). Occasionally one lung field was more affected than the other (fig. 3). Coalescence of the nodal shadows had resulted in patchy parenchymal opacities in a few skiagrams.

The remaining skiagrams presented partial appearances of this pathognomonic picture, or chronic changes of a different nature, or no deviation from the normal. The inconstant and variable nature of the radiological changes is elucidated by analysing the differing appearances in relation to the duration of the clinical course of the syndrome (Table I). It will be evident from such a study that the radiological appearances of the lungs tend to vary at different stages of the syndrome.

TABLE I
Duration of Clinical Course.

<i>Radiological features</i>	<i>Under 1 month</i>	<i>1 to 3 months</i>	<i>3 to 6 months</i>	<i>6 to 12 months</i>	<i>Over 1 year</i>	<i>Total cases</i>
Skiagrams showing pathognomonic appearances—linear striations and nodal mottling of the lungs	6	26	10	2	2	46
Skiagrams showing partial appearances—linear striations only	8	6	2	1	3	20
Skiagrams showing appearances of chronic bronchitis, or emphysema, or chronic pleural thickening	0	0	0	2	4	6
Skiagrams showing no deviation from the normal lung picture	6	2	2	2	4	16
Total number of skiagrams	20	34	14	7	13	88

The above analysis would justify the inference that :

- (a) The characteristic radiological changes of this syndrome attain a remarkable prominence between the second and sixth months of the clinical course.
- (b) These appearances are relatively uncommon in the initial and late stages.
- (c) The lungs may be normally radiolucent at any stage of the syndrome.
- (d) Chronic pulmonary changes are incidental in long-standing cases.

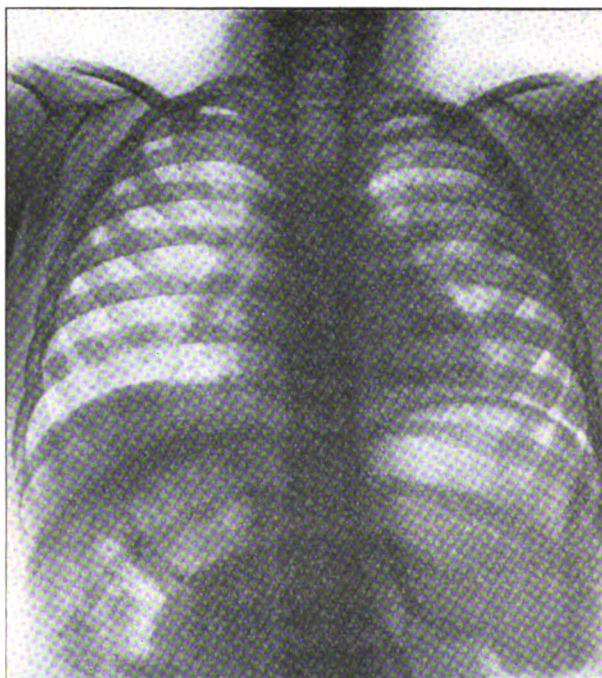


FIG. 3 (Case 96).—Skiagram showing accentuation of the finer lung striations and loss of radiolucency in both lung fields with mottling prominently distributed throughout the entire right lung.

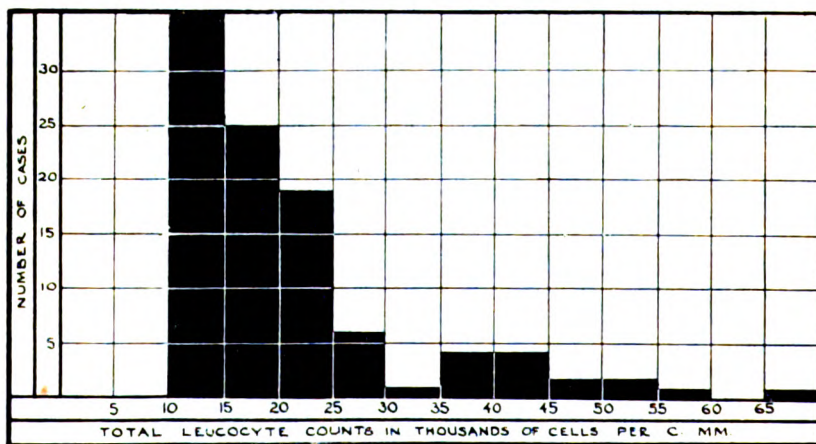


FIG. 4.

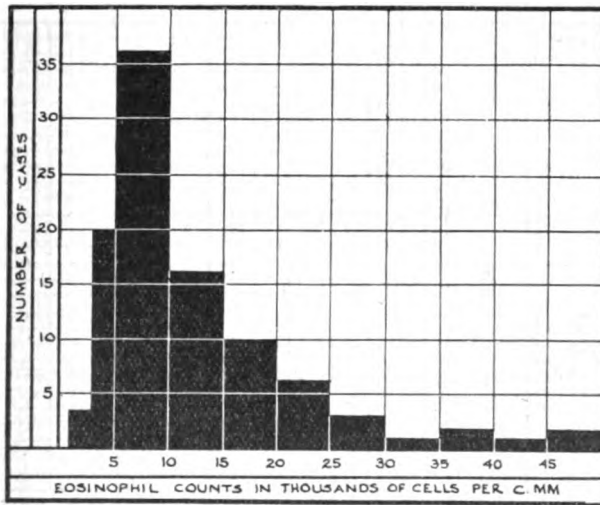


FIG. 5.

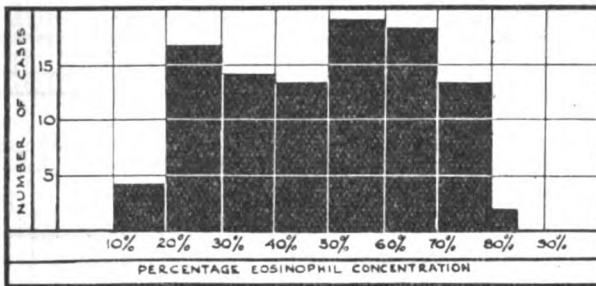


FIG. 6.

* PATHOLOGY

The Blood.—The most constant and prominent pathological feature of this syndrome is its remarkable eosinophilic leucocytosis. The total leucocyte counts in this series of cases ranged between 10,000 and 70,000 (fig. 4), and the eosinophils between 1,000 and 50,000 cells per c.mm. (fig. 5), or from 10 to 85 per cent (fig. 6). The relation between eosinophilia and leucocytosis is illustrated in fig. 7. Sudden, spontaneous drops in eosinophilia lasting one to four days were occasionally observed; diagnosis might easily be missed at such times. Ruptured eosinophils were detected once (Case 95), and more prominent granulation and nucleation of cells was sometimes evident, but no immature or poorly staining eosinophils were seen.

Severity of symptoms was not proportionate to degree of eosinophilia. Massive eosinophilia was often seen with mild clinical manifestations, as in Case 77, which represents the highest eosinophil count recorded (49,536 cells per c.mm.). Conversely, distressing paroxysms, and even status asthmaticus, occurred with counts of 1,000 to 4,000 eosinophils per c.mm. No relation was evident between degree of eosinophilia and character of radiological changes in the lungs.

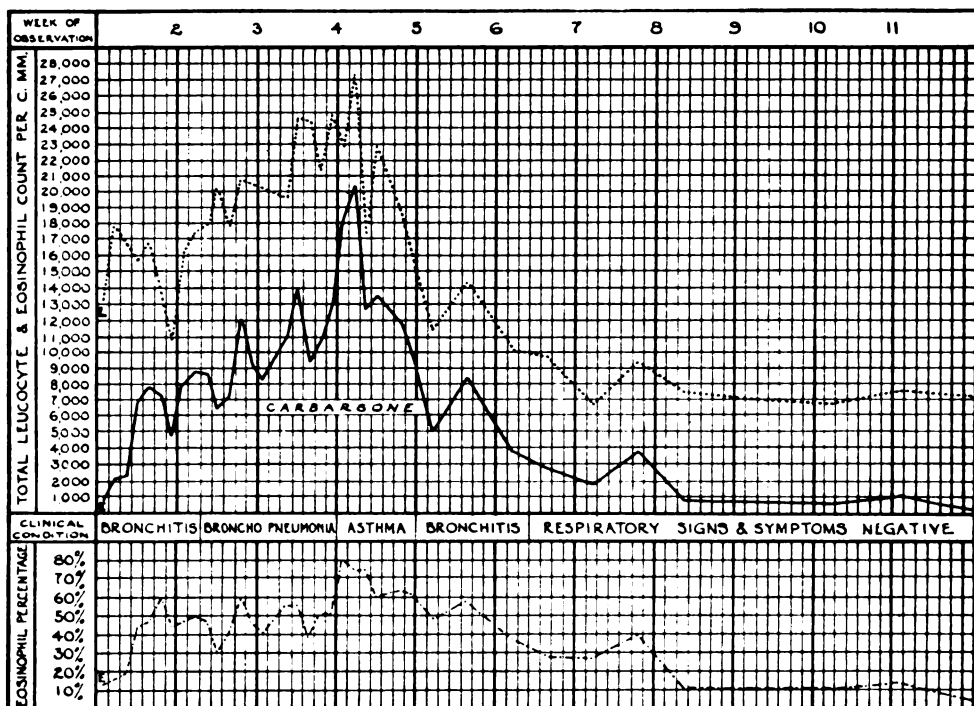


FIG. 7 (Case 94).—Total leucocyte and eosinophil chart. E = eosinophils. L = total leucocytes.

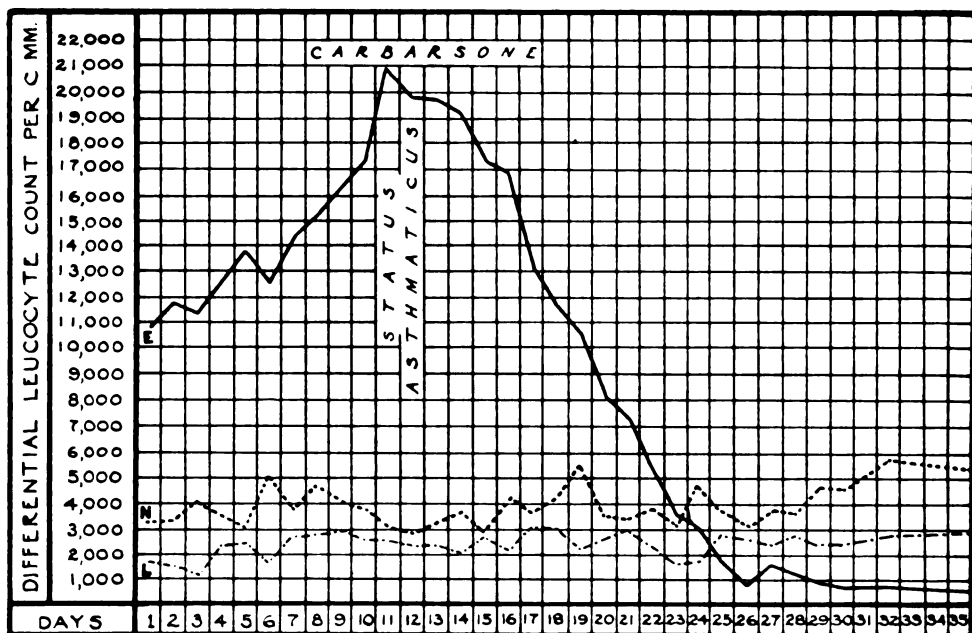


FIG. 8 (Case 49).—Differential leucocyte chart. E = eosinophils. N = neutrophils. L = lymphocytes.

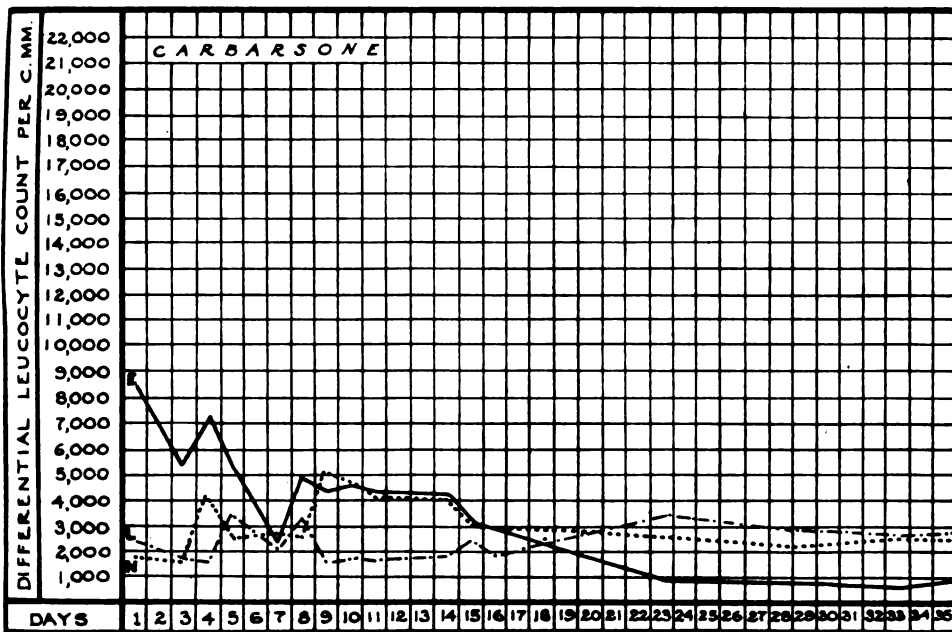


FIG. 9 (Case 95).—Differential leucocyte chart.

The neutrophil and lymphocyte counts generally showed no appreciable abnormality (fig. 8) but unaccountable, irregular variations sometimes occurred (fig. 9), while in certain cases of massive leucocytosis the counts rose to between 8,000 and 14,000 neutrophils, and to between 6,000 and 8,000 lymphocytes per c.mm.

The erythrocyte and hæmoglobin contents, estimated in about 50 per cent of the cases, were within normal limits except in some of the chronic asthmatics, malarial subjects, and worm-infested patients, who showed a mild secondary anæmia. The erythrocyte sedimentation rate, estimated in about 25 per cent of the cases by the Westergren method, showed rises to between 25 and 50 mm. after the first hour in a few bronchitic patients with fever. Blood smears were negative for malaria in all but 1 of 11 patients with malarial histories. The Wassermann and Kahn reactions were tested in a few of the earlier cases with negative results; it has since been reported that this syndrome may present a non-specific Wassermann reaction (D'Abrera, 1946b), as might occur in other nonluetic diseases, e.g. malaria, leprosy, leishmaniasis, tuberculosis, infective hepatitis, etc.

The Sputum.—The technique devised by Carter *et al.* for collecting and examining twenty-four-hour specimens of sputum for mites was employed in 67 of the 100 patients.

Ehrlenmeyer flasks, thoroughly washed and flushed with running water and plugged with rubber stoppers similarly treated, were placed in decontaminated tin cans containing cotton-wool saturated in pyrethrum solution and tightly stoppered with lids smeared with pyrethrum impregnated vaseline. Each flask contained 10 c.c. of 1 per cent KOH to disintegrate and preserve the mucopurulent sputum. Patients were instructed to open the can and place the lid upside down on a clean glass tumbler, to unstopper the

flask without removing it from the can, to expectorate direct into the flask while holding the stopper in the hand, and to restopper the flask and can immediately afterwards. These precautions exclude contamination of the sputum by mites from extraneous sources.

The material was treated with 10 drops of Löffler's alkaline methylene-blue and enough formalin to give a 10 per cent concentration, and left aside for twenty-four hours. It was then centrifuged, and the deposit examined microscopically. Scrupulous precautions against accidental contamination of specimens, apparatus, and materials by extraneous mites must be adopted throughout the process.

Early experience proved that searching for mites, which are usually present in meagre numbers in a comparatively large quantity of material, is a lengthy and laborious procedure requiring not merely diligence and perseverance but also skilled technique and adequate facilities. Whereas the search for mites was often abandoned in the earlier cases with consequent "mite-negative" reports, specimens of sputum from later cases referred to a civil entomological laboratory were specially examined by trained experts who isolated mites in almost every case, with the following results:—

Total number of cases examined	..	67
Cases where mites were present	..	42
Cases where no mites were seen	..	25

Four genera of acarine mites were recognized in these examinations—*Tarsonemus*, *Tyroglyphus*, *Glyciphagus* and *Carpoglyphus*—besides two unidentified types also isolated. Various stages of the life-cycle were seen—adult mites, male and female, hypopial forms, nymphs, larvæ, and eggs—the last suggesting that mites were probably breeding in the bronchi or lungs of their hosts. It was usual to find a single species of mite only in each case, the largest number occurring in the sputum of a baker (Case 44), where 15 *Tarsonemus* mites were isolated. The most striking instance of a mixed infestation occurred in a business man's sputum from which 18 mites representing all four genera named above were isolated (Case 95); mites of the same types were recovered in quantity from the débris, litter, and dust amid which this patient had worked for the three or four months preceding his illness.

Mites were apparently more freely expectorated during the early stages of arsenical treatment, notably during a Herxheimer-Jarisch reaction, when it was usually easier to find mites in the sputum, often in macerated or broken condition.

Analysis of the 42 "mite-positive" cases in relation to the degree of eosinophilia and to the duration of the clinical condition gave the following results:

<i>Eosinophil count</i> <i>per c.mm.</i>	<i>Number of</i> <i>patients</i>	<i>Duration of</i> <i>symptoms</i>	<i>Number of</i> <i>patients</i>
1,000 to 5,000	10	Under 1 month	8
5,000 to 10,000	16	1 to 3 months	19
10,000 to 20,000	7	3 to 6 months	1
20,000 to 30,000	3	6 to 12 months	5
30,000 to 50,000	6	Over 1 year	9
Total 42		Total 42	

No abnormality other than the presence of mites, and occasionally of eosinophil leucocytes, was evident in the sputum.

The Fæces.—Microscopic examination of fæces for evidence of intestinal parasitism, particularly helminthiasis, was done in about 75 per cent of the cases, and resulted in the following findings :

	Cases		Cases
<i>Ankylostoma duodenale</i> ..	3	<i>Entamæba histolytica</i> ..	3
<i>Ascaris lumbricoides</i> ..	3	<i>Trichomonas fæcalis</i> ..	2
<i>Blastocystis hominis</i> ..	4	<i>Trichuris trichiura</i> ..	3

Anthelmintic treatment, administered where indicated before proceeding with the investigation, produced little or no reduction in eosinophilia.

The Urine.—One woman gave a history of glycosuria six years previously. No abnormality of the urine was revealed on routine examination in any case in this series.

ÆTIOLOGY

Age, Sex and Race.—Seventy-five per cent of the patients in this investigations were Ceylonese soldiers of various races, between the ages of 20 and 40, representing all units in the Ceylon Army Command. Of the 25 civilians, the youngest patient (Case 96) was a child of 4 years whose symptoms had commenced eight months previously, and the oldest (Case 100) was a European entomologist aged 58. The dominant rôle of environment in the ætiology of this syndrome excludes the attachment of any significance to such incidental matters as the average age of patients in this series, or the proportion of 96 males to 4 females, or of 98 Ceylonese to 2 Europeans.

Two married couples were affected. It seemed likely that one of these couples acquired their infection from their environment, a musty old clothes shop where they lived and worked. In the second instance, the husband, a Malay conductor of a coconut plantation, acquired asthma after working in copra stores and kilns, and his wife, though not exposed to any such obvious risk of mite inhalation, developed symptoms three years later.

Personal History.—Only 3 patients had previously suffered from asthma : none of the others had exhibited any past allergic tendencies. No history suggestive of tuberculosis, pneumokoniosis, bronchomycosis, or of any previous disease or disorder of the blood was given by any of the patients. Other past illnesses reported were : pneumonia, 3 cases ; scabies, 9 cases ; unspecified dermatoses, 5 cases ; malaria, 11 cases ; dysentery, 5 cases ; glycosuria, 1 case.

Family History.—Familial tendency to asthma was recorded in 5 cases only, no allergic inheritance being evident in the remainder. No evidence of any hereditary blood disorder was revealed in any of the case-histories. A tuberculous taint was disclosed in 3 family histories.

Environment and Occupation.—An ætiological link of significance between the clinical phenomena of the syndrome and its postulated pathology, pulmonary acariasis, was evident in a large proportion of the cases in this investigation. The environmental and occupational circumstances affecting no less than 80 per cent of the patients in this series were such as to expose these

persons to a very evident risk of inhaling airborne mites from a heavily contaminated atmosphere (Table II).

TABLE II

Group	Nature of occupation	Number
(1)	Workers in Army ration stores, cookhouses, bakeries, ration transport services ; in civilian grocery shops, food warehouses, and forage mills	56
(2)	Personnel quartered in or near places where food products were stored	8
(3)	Workers in Army linen stores and in civilian textile shops	6
(4)	Workers in Army ordnance stores, and in civilian general stores.. ..	6
(5)	Workers in copra stores, mills, and kilns	3
(6)	Workers in manure mills and stores	2
Total		81

Through the nature of their occupation these 81 patients were obviously exposed to inhalation of dusty air contaminated with mites, particularly those in Group (1) who were in close contact with foodstuffs such as flour, cereals, sugar, tea, coffee, cheese, condiments, dehydrated meat, fish, fruit and vegetables. None of these 56 persons showed evidence of specific sensitization to any of these foodstuffs on ingestion. Grainshop workers comprised the largest group (39) of a series of 140 patients examined in Bombay (Jhatkia, 1946). *Tyroglyphus* mites are often abundant amid cereals and other stored food products. These mites also occur in copra, the dried kernel of the coconut used for expressing oil for the manufacture of margarine and soaps, and are the cause of copra itch, a form of acarine dermatitis akin to that caused by cheese mites in dock workers (Thomas, 1942). The ubiquitous *Tarsonemus* mites are plentiful in dusty houses, textile shops and other stores, in litter, and débris, e.g. straw, chaff, cotton fluff, etc. The genera *Tyroglyphus* and *Glyciphagus* also occur among house mites, and infest stored vegetables, fruit and meat. *Carpoglyphus* mites were the largest but least common of those found in this investigation. All these mites can become airborne, and are likely to have been particularly prevalent in the atmosphere to which the 81 workers in Table II were exposed, and this would, accordingly, seem to be the cardinal aetiological factor in this series.

The remaining 19 patients of the series comprised 1 entomologist, 1 business man, 1 child, 1 schoolmistress, 1 schoolgirl, 1 bandsman, 1 science student, 2 carpenters, 2 quarry workers, 2 tractor operators, 2 tinsmiths, 2 medical orderlies, and 2 housewives.

Of exceptional interest was the case of the entomologist (Case 100), who developed severe asthmatic bronchitis after examining samples of straw, litter, and sweepings collected from the workroom of another patient, the business man (Case 95); all four genera of mites infesting this material were isolated from the sputum in Case 95, and two of them in Case 100. The child (Case 96) acquired the syndrome after moving into an old house previously used as a paper store. The schoolmistress developed asthma while teaching in a dusty, commercial quarter crowded with grocery shops. The schoolgirl was one of two boarders in a convent who both became affected after coming to share a dormitory. The carpenters might have been affected by mites breeding in sawdust in their workshops, but operatives such as quarrymen, tractor drivers, or smiths, though engaged in dusty trades, are not necessarily predisposed to inhaling mites. Nor was such

predisposition evident in the circumstances of the student, the bandsman, the medical orderlies, or the housewives (one the wife of a European planter, the other the wife of the Malay estate conductor previously mentioned).

A series of controls (Tables III, IV, V) were examined to test the possibility that mites may occur in the sputum of patients with non-eosinophilic respiratory disorders, or of healthy persons, particularly those exposed to the risk of inhaling mites.

TABLE III.—CASES OF RESPIRATORY DISORDERS NOT ASSOCIATED WITH EOSINOPHILIA

No.	Case notes	Blood report	X-ray report	Sputum report
A. 1	Lt.-Colonel, Engineers Unit, aged 55, European. Chronic asthma since being gassed in 1914–1918 war	W.B.C. 6,200 E. 5% (310)	Bronchitis	Mites nil
A. 2	Lt.-Colonel, Infantry Unit, aged 52, European. Asthma, four weeks, sudden onset in Maldivé islands	W.B.C. 7,200 E. 8% (576)	N.A.D.	nil
A. 3	Major, Medical Unit, aged 42, Ceylonese. Bronchopneumonia. P.H. asthma, hay-fever, eczema, migraine	W.B.C. 10,200 E. 3% (306)	Bronchio- litis	nil
A. 4	Flying Officer, Air Force, aged 40, European. Spasmodic asthma four years, following bronchitis	W.B.C. 4,200 E. 4% (168)	N.A.D.	nil
A. 5	Field Instructor, Engineers Unit, aged 31, Ceylonese. Tracheitis and bronchitis four months	W.B.C. 8,000 E. 7% (560)	—	nil
A. 6	Clerk, Medical Unit, aged 41, Ceylonese. Chronic asthmatic bronchitis seventeen years	W.B.C. 9,800 E. 9% (882)	N.A.D.	nil
A. 7	Quartermaster's store clerk, Artillery Unit, aged 29, Ceylonese. Bronchitis six months	W.B.C. 8,000 E. 6% (480)	—	nil
A. 8	Ordnance store clerk, Infantry Unit, aged 42, Ceylonese. Fœtid bronchitis, recurrent two years	W.B.C. 11,200 E. 2% (224)	Bronchiec- tasis	nil
A. 9	Housewife, aged 30, Ceylonese, primigravida seven months. Spasmodic asthma since third month of pregnancy	W.B.C. 7,800 E. 5% (390)	N.A.D.	nil
A. 10	Child, aged 6, Ceylonese. Recurrent bronchitis and asthma one year	W.B.C. 7,000 E. 6% (420)	N.A.D.	nil
A. 11	Child, aged 4, Ceylonese. Asthma one and a half years, becoming progressively worse	W.B.C. 6,000 E. 6% (360)	—	nil
A. 12	Housewife, aged 50, Ceylonese. Chronic asthmatic bronchitis sixteen years	W.B.C. 7,600 E. 10% (760)	—	nil
A. 13	Schoolmaster, aged 38, Ceylonese. Recurrent bronchitis and tracheitis in rainy seasons six years	W.B.C. 7,600 E. 7% (532)	—	nil

TABLE IV.—SERVICE PERSONNEL EMPLOYED IN ARMY STORES, COOKHOUSES, ETC.

No.	Personal history	Present health	Sputum report
B. 1	Captain Quartermaster, Medical Unit, aged 36, Ceylonese. Six years' service in medical and ordnance stores. <i>P.H.</i> nil abnormal	N.A.D.	Mites nil
B. 2	Regimental Serjeant-Major, Medical Unit, aged 44, Ceylonese. Two years' service in ration stores. <i>P.H.</i> renal lithiasis	„	„
B. 3	Regimental Quartermaster-Serjeant, Medical Unit, aged 41, Ceylonese. Four years' service in ration stores. <i>P.H.</i> bronchitis	„	„
B. 4	Staff-Serjeant, Medical Unit, aged 42, Ceylonese. Two and a half years' service in hospital linen stores. <i>P.H.</i> nil abnormal	„	„
B. 5	Serjeant, Medical Unit, aged 43, Ceylonese. Three years' service in ration stores. <i>P.H.</i> nil abnormal	„	„
B. 6	Corporal, Medical Unit, aged 30, Ceylonese. Four years' service in ration stores. <i>P.H.</i> nil abnormal	„	„
B. 7	Corporal, Medical Unit, aged 30, Ceylonese. Six years' service in medical stores. <i>P.H.</i> typhoid fever	„	„
B. 8	Corporal, Medical Unit, aged 31, Ceylonese. Five years' service in medical, ordnance and ration stores. <i>P.H.</i> malaria	„	„
B. 9	Corporal, Army Service Unit, aged 28, Ceylonese. Four years' service in armoury. <i>P.H.</i> nil abnormal	„	„
B. 10	Private, Infantry Unit, aged 28, Ceylonese. Five months' service in Officers' mess and ration stores. <i>P.H.</i> nil abnormal	„	„
B. 11	Private, Infantry Unit, aged 28, Ceylonese. Two years' service as mess orderly. <i>P.H.</i> nil abnormal	„	„
B. 12	Private, Infantry Unit, aged 24, Ceylonese. Four and a half years' service in cookhouse. <i>P.H.</i> nil abnormal	„	„
B. 13	Private, Infantry Unit, aged 28, Ceylonese. Six months' service in cookhouse and ration store. <i>P.H.</i> nil abnormal	„	„
B. 14	Civilian mess waiter, Army Service Unit, aged 26, Ceylonese. Four and a half years' service in mess and ration store. <i>P.H.</i> nil abnormal	„	„
B. 15	Civilian storeman, Army Service Unit, aged 29, Ceylonese. Seven and a half years' service in linen stores. <i>P.H.</i> nil abnormal	„	„
B. 16	Civilian storeman, Army Service Unit, aged 39, Ceylonese. Nineteen years' service in ordnance and linen stores. <i>P.H.</i> nil abnormal	„	„
B. 17	Civilian storeman, Army Service Unit, aged 28, Ceylonese. Eleven years' service in ordnance stores and armoury. <i>P.H.</i> nil abnormal	„	„

TABLE V.—PERSONS IN GOOD HEALTH SELECTED AT RANDOM FOR SPUTUM EXAMINATION

No.	Personal history	Present health	Sputum report
C. 1	Housewife, aged 64, Ceylonese. <i>P.H.</i> renal lithiasis, eczema, hay-fever, migraine	N.A.D.	Mites nil
C. 2	Medical practitioner, aged 46, Ceylonese. (Same subject as Case A. 3, re-examined four years later)	"	"
C. 3	Medical practitioner, aged 47, Ceylonese. <i>P.H.</i> spasmodic asthma at high altitudes	"	"
C. 4	Housewife, aged 45, Ceylonese. <i>P.H.</i> thyro-ovarian dysfunction	"	"
C. 5	Housewife, aged 45, Ceylonese. <i>P.H.</i> hay-fever, eczema, migraine	"	"
C. 6	Motor engineer, aged 43, Ceylonese. <i>P.H.</i> hay-fever, Menière's syndrome, eczema	"	"
C. 7	Radio engineer, aged 37, Ceylonese. <i>P.H.</i> hay-fever, eczema	"	"
C. 8	Surveyor, aged 30, Ceylonese. <i>P.H.</i> hay-fever, asthma, urticaria	"	"
C. 9	Estate agent, aged 41, Ceylonese. <i>P.H.</i> nil abnormal	"	"
C. 10	Housewife, aged 41, Ceylonese. <i>P.H.</i> herpes zoster	"	"
C. 11	Schoolgirl, aged 13, Ceylonese. <i>P.H.</i> chickenpox, paratyphoid fever	"	"
C. 12	Housewife, aged 32, Ceylonese. <i>P.H.</i> nil abnormal	"	"
C. 13	Housewife, aged 30, Ceylonese. <i>P.H.</i> nil abnormal	"	"
C. 14	Accountant, aged 34, Ceylonese. <i>P.H.</i> asthma, hay-fever	"	"

The specimens of sputum collected from the foregoing control cases were subjected to precisely the same laboratory examination as that employed for the "mite-positive" patients in this investigation. Supposing mites are commonly present in the sputum of inhabitants in the tropics, one might expect to see evidence of this in controls of these types. Yet, despite diligent search, not a single mite was detected in any of these controls.

The patients in Table III, though suffering from asthma, bronchitis, and other respiratory disorders, exhibited neither eosinophilia in their blood nor mites in their sputum.

All the persons in Table IV belong to the category of workers exposed to the same risks of inhaling mites as the majority of patients in Table II, yet, unlike the latter, they presented neither respiratory symptoms nor evidence of pulmonary acariasis.

There was neither evidence of predisposition to mite inhalation through occupation or environment, nor of the occurrence of mites in the sputum of any of the healthy persons in Table V, about half of whom were, incidentally, subjects of the allergic diathesis.

The early recognition by Carter and his co-workers of the danger of contamination led to the adoption of scrupulous precautions in the collection and examination of sputum. The adequacy of these precautions, which have

been carefully followed in the present investigation, is established by the results of these control experiments. Accordingly, the presence of mites in the sputum of patients examined under such conditions cannot be disregarded as accidental or incidental occurrences.

PATHOGENESIS

These observations support the assumption that airborne mites are not usually present in the sputum of tropical inhabitants, but that they may affect the respiratory passages of susceptible subjects, causing asthma and bronchitis in association with eosinophilic leucocytosis. The constitutional susceptibility that has been associated with this syndrome (Patel, 1945) may, possibly, be related to sensitization to mites.

Until the morbid anatomy of this disorder can be studied, its pathogenesis will remain hypothetical, but further elucidation of the problem may meanwhile be expected from experimental work. Carter and D'Abrera (1946*b*), having induced spasmodic bronchitis and sustained eosinophilia in a monkey by intratracheal introduction of tyroglyphid mite eggs, were able to abolish the eosinophilia, after spontaneous cure of the cough, with subcutaneous injections of an extract of the same mites—an observation that suggests a process of specific desensitization. Davis (1945) has suggested an analogy between the nodal opacities in the pulmonary skiagrams in this syndrome and the disseminated focal lesions demonstrated by him in the lungs of monkeys infested with *Pneumonyssus*, which are true parasitic mites; these lesions, consisting of capsules of heavily pigmented granulation tissue, lined internally with epithelium, and containing a mite in the centre, are said to be generally distributed in close proximity to the bronchioles. Following trends of contemporary opinion that the functions of the eosinophil cell are the neutralization of toxins of protein origin and the transportation of histamine, Carter and D'Abrera (1946*a*) support the view that the association of asthma with eosinophilia is due to, first, increased activity of eosinophils in response to the presence of a foreign protein; second, liberation of histamine from the protein or by its effects on the tissues; and, third, transportation of the histamine absorbed by the eosinophils to the vasomotor centres where the asthmatic spasm is initiated. The potentialities of mites as allergens in the gastro-intestinal tract and the skin are recognized, implying that they produce toxic emanations. This may well be the explanation of the rôle of mites in the pathogenesis of this syndrome.

TREATMENT

Symptomatic Treatment.—Most of the patients had already received, or were given, a preliminary course of treatment with the usual antispasmodics, sedatives, and expectorants. These measures afforded temporary easement of symptoms, but effected no lasting cure clinically, hæmatologically, or radiologically.

Specific Treatment.—Since Weingarten (1943) first reported the dramatic response of this syndrome to arsenical therapy, this method of treatment has

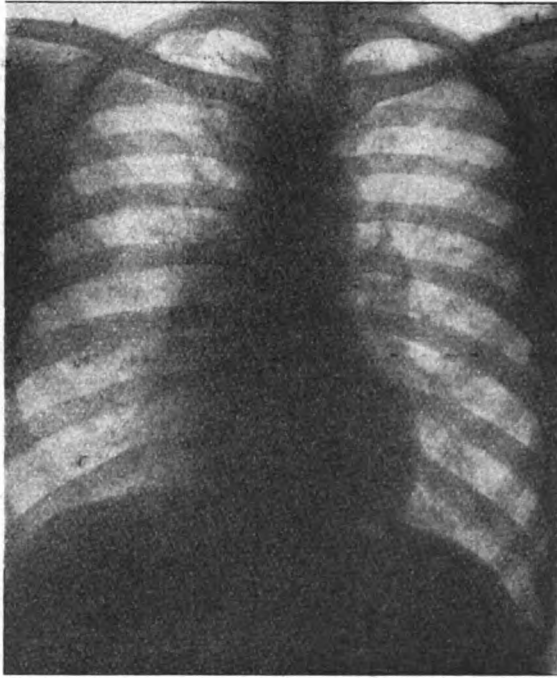


FIG. 10 (Case 6).—Skiagram illustrating radiological response to arsenical therapy.
Before treatment.

not been surpassed. Both parenteral and oral administration of arsenic were employed in this investigation, and the therapeutic response invariably progressed to complete recovery.

Parenteral therapy with neoarsphenamine, tryparsonum, or acetylarsan was adopted in 12 cases. Injections were given once or twice weekly in graduated doses from 0.1 gm. to 0.5 gm. Clinical improvement was usually evident after the second or third injection. From four to eight injections were necessary to establish clinical cure.

Oral medication was employed in the remaining cases with carbarsone, leucarsone, or stovarsol in doses of one tablet twice daily after meals. Some of the earlier cases were subjected to prolonged treatment through a mistaken notion that the adequacy of therapy should be assessed by hæmatological response. When it became evident that the decline in eosinophilia continued after cessation of treatment, the period of medication was considerably curtailed. Clinical relief was often evident after a few days of treatment. Many patients exhibited a Herxheimer-Jarisch reaction with a rise in eosinophilia, usually between the third and fifth days of treatment; status asthmaticus occurred in 3 of these cases. The alleviation of asthma was most rapid and striking in cases where arsenical therapy had provoked a severe initial exacerbation, and in cases of massive eosinophilia. Mild cases generally showed a tardy response to oral arsenic; the supplementation of treatment by means

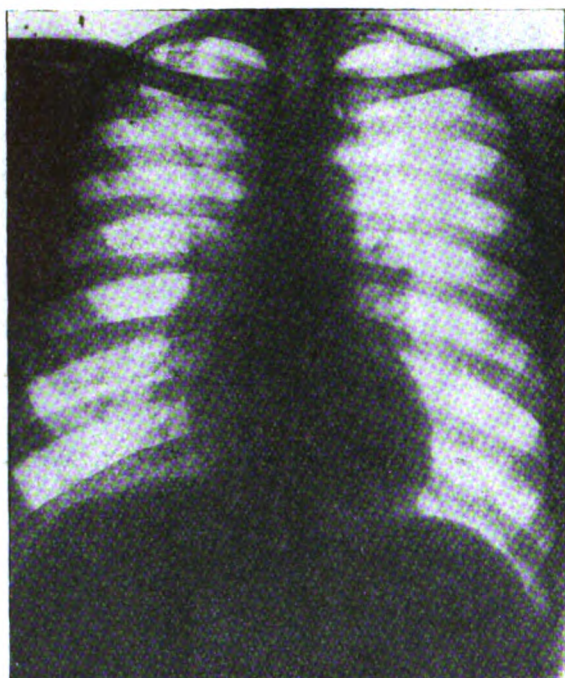


FIG. 11 (Case 6).—Skiagram illustrating radiological response to arsenical therapy.
After treatment.

of one or two intravenous injections appeared to accelerate the response in a few cases.

The assessment of oral therapy with arsenic may be based on the following observations :

(1) The adequate total dosage for effective control of the syndrome varied between ten and twenty 0.25 gm. tablets of carbarsone, involving the ingestion of between 0.72 gm. and 1.44 gm. of arsenic.

(2) Control of respiratory symptoms was established by the end of the first week of treatment in the majority of cases.

(3) Normal radiolucency of the lungs was restored within two to four weeks of commencing treatment (figs. 10 and 11).

(4) Stabilization of the total leucocyte and eosinophil concentrations within normal limits was sometimes observed as early as the third week (figs. 8 and 9), and in a few cases was delayed until the ninth or tenth week after commencing treatment (fig. 7), but generally was evident by the sixth or seventh week.

There was no evident advantage in parenteral treatment except as an adjuvant to oral medication in chronic cases with low eosinophilia. The necessity for repeated injections and the longer time required for a course of such treatment are obvious disadvantages.

Precautions were adopted against toxic complications resulting from intolerance to arsenic. Rest was enjoined in every case during treatment. To avert cumulative action of arsenic, oral medication was generally suspended

after five days and resumed, where necessary, after an interval of two days. Vitamin C was given with carbarsone to a few patients who complained of headache or developed conjunctival congestion. Sodium thiosulphate was administered in most of the cases treated by arsenical injections. Only one patient showed signs of incipient encephalitis, which was controlled by prompt treatment. During the early part of this investigation arsenic was suspended at the onset of an exacerbation, but it was not considered necessary to continue this measure.

The administration of organic arsenicals produces such constant and striking cure in this syndrome that it constitutes a therapeutic test of significance, but precautions must be taken whenever it is so employed for diagnostic purposes lest harmful results follow in negative cases.

Recurrences.—Eight patients had recurrences (3 of them having relapsed twice) within six to eighteen months after treatment, with return of hæmatological and radiological changes. Mites were detected in the sputum of 3 out of 5 cases examined. All relapse cases responded satisfactorily to arsenic. All but one recurrence followed reversion to the same occupation associated with the primary attack, suggesting acarine reinfestation. The first recurrence in Case 19 seemed to be due to this, but the second might have been due to recrudescence of a latent infestation, in the absence of obvious predisposition to further reinfestation.

CASE REPORTS

Brief notes of some of the cases referred to in this paper are appended to illustrate various observations mentioned.

Case 19.—Army hospital linen store orderly, aged 21, Ceylonese. Asthma, duration one year, onset gradual following bronchitis. *F.H.* 1 brother tuberculous, another asthmatic. *P.C.* Faces: *Ascaris lumbricoides* ova +. Blood: W.B.C. 16,000, E. 46% (7,360). X-ray: eosinophilic lung picture. Sputum: *Tarsonemus* mites +. Treatment: carbarsone 1 tab. b.d. for ten days. Clinical cure after ninth day. Re-examined after fourth week. Blood: W.B.C. 7,800, E. 4% (312); X-ray normal. Sputum: mites nil. First recurrence eight months after resuming original duties. W.B.C. 22,000, E. 50% (11,000). X-ray: eosinophilic lung picture. Sputum: *Tarsonemus* mites +. Treatment repeated, response good. Discharged from Army, joined a Government office as clerk. Second recurrence eighteen months after first. Blood: W.B.C. 43,200, E. 72% (32,536). Treatment repeated, response good.

Case 40.—Army truck driver, aged 25, Ceylonese. Asthma, duration three and a half months, onset sudden on board ship transporting rations for troops in Egypt. *P.H.* malaria. *P.C.* Blood: W.B.C. 11,600, E. 61% (7,076); R.B.C. 4,000,000; Hb. 75%; malarial parasites nil. X-ray: ground glass haze both lung fields. Sputum: *Tyroglyphus* mites +. Treatment: 5 weekly injections N.A.B., 0.15 to 0.5 gm. Clinical cure after third injection. Blood: two weeks after fifth injection—W.B.C. 9,000, E. 8% (720). X-ray: n.a.d.

Case 44.—Army baker, aged 34, Ceylonese. Asthma, duration three months, onset gradual following spasmodic bronchitis. *P.C.* Blood: W.B.C. 50,000, E. 78% (39,000); E.S.R. 8½ mm. X-ray: appearances of eosinophilic lung. Sputum: 15 *Tarsonemus* mites isolated. Treatment: stovarsol 1 tab. b.d. for fourteen days. Herxheimer-Jarisch reaction with rise in eosinophilia on fourth day of treatment. Clinical cure after ninth

day. Blood and X-ray picture normal one month after end of treatment. Recurrence eight months later after reverting to original duties. Treatment: carbarsone 1 tab. b.d. for ten days, response good.

Case 49.—Army hospital nursing orderly, aged 23, Ceylonese. Asthma, duration two weeks, following febrile bronchitis. *P.C.* Temperature 99° to 100° in the evenings. Spleen just palpable. Blood: W.B.C. 15,600, E. 70% (10,920); E.S.R. 14 mm. X-ray: accentuation of fine lung striations both fields, no mottling. Sputum: *Tyroglyphus* mites +. Treatment: carbarsone 1 tab. b.d. for ten days. Herxheimer-Jarisch reaction with status asthmaticus, rise of eosinophilia and expectoration of macerated mites on fourth and fifth days of treatment, followed by rapid clinical and hæmatological improvement (fig. 8).

Case 54.—Army ration store orderly, aged 24, Ceylonese. Asthma, duration two months, onset gradual, following bronchitis and bronchopneumonia. *P.H.* recurrent malaria. *P.C.* afebrile. Spleen just palpable. Blood: W.B.C. 13,600, E. 25% (3,400); R.B.C. 3,250,000; Hb. 60%. X-ray: diffuse linear striations in both lung fields. Sputum: *Tyroglyphus* mites +. Treatment: carbarsone 1 tab. b.d. for ten days. Clinical cure after fifth day. Blood and X-ray picture normal after eighth week.

Case 58.—Army cook, aged 34, Ceylonese. Spasmodic bronchitis, duration three months. *F.H.* one brother tuberculous. *P.H.* dysentery. *P.C.* Fæces: *Ascaris lumbricoides* ova +. Blood: W.B.C. 22,400, E. 60% (13,440); R.B.C. 3,500,000; Hb. 65%; E.S.R. 7½ mm. X-ray: lung fields clear. Sputum: T.B. nil; *Glyciphagus* mites +. Treatment: carbarsone 1 tab. b.d. for seven days. Recovery good, uneventful. Blood two months after treatment—W.B.C. 6,000, E. 4% (240).

Case 63.—Army ration transport orderly, aged 26, Ceylonese. Asthma, duration three months, onset sudden. *P.C.* Blood: W.B.C. 51,000, E. 80% (41,120); E.S.R. 30 mm. X-ray: mottling of both lung fields. Sputum: *Tarsonemus* mites +. Treatment: carbarsone 1 tab. b.d. for ten days. Herxheimer-Jarisch reaction on fourth day of treatment, followed by complete clinical cure. Recurrence nine months after return to original duties: W.B.C. 24,000, E. 50% (12,000). X-ray: increased linear striations with slight mottling of both lungs. Treatment repeated, response good. Blood and X-ray picture returned to normal in one month as before.

Case 66.—Army linen store orderly, aged 24, Ceylonese. Asthma, duration one week, onset sudden. *P.C.* Blood: W.B.C. 10,800, E. 30% (3,240). X-ray: eosinophilic lung picture. Sputum: mites nil. Treatment: carbarsone 1 tab. b.d. for ten days. Status asthmaticus on fourth and fifth days, with macerated (unidentified) mites in sputum, and eosinophilia of 3,500. Recovery uneventful thereafter.

Case 77.—Civilian copra storeman, aged 48, Ceylonese. Spasmodic bronchitis with mild asthmatic attacks, duration one year, onset gradual. *P.H.* recurrent itchy eruption on hands and forearms about three or four years previously (? "copra itch"). *P.C.* skin n.a.d. Blood: W.B.C. 68,800, E. 72% (49,536). X-ray: appearances of chronic bronchitis. Sputum: *Tyroglyphus* mites +. Treatment: N.A.B. 2 injections, 0.1 gm. and 0.2 gm. during first week, followed by carbarsone 1 tab. b.d. for seven days. Clinical relief at end of treatment. Hamatological response delayed for a further month—W.B.C. 9,000, E. 10% (900).

Case 91.—Civilian grocery store salesman, aged 29, Ceylonese. Asthma, duration one year, onset sudden, recurrences frequent including three attacks status asthmaticus for which he had received various forms of treatment, including lumbar puncture, in hospital. *P.C.* Blood: W.B.C. 16,000, E. 25% (4,000). X-ray: lung fields clear. Treatment: carbarsone 1 tab. b.d. for ten days. Recovery dramatic.

Case 94.—Schoolgirl, aged 16, Ceylonese. Developed bronchitis at the same time as a schoolmate with whom she had recently come to share a dormitory. First seen with bronchitis, which developed into bronchopneumonia, when patient was removed to a nursing home and treated with sulphapyridine, etc. Asthma developed during fourth week with rising eosinophilia (fig. 7). During carbarsone treatment (third and fourth weeks), $\frac{1}{2}$ tab. b.d. for twelve days, *Tyroglyphus* mites were found in sputum. Lungs cleared ten days after treatment. Eosinophilia persisted for about five weeks longer.

Case 95.—Civilian business man, aged 33, Ceylonese. Asthma, duration two months, onset gradual, following coryza and bronchitis. For previous four months patient had been engaged in unpacking household effects packed for storage during the war in straw, wood shavings, jute hessian, and paper. Asthmatic attacks had become severe during preceding fortnight, causing insomnia, asthenia, and loss of weight. *P.H.* asthma from age 7 to 13 years, cured by turbinectomy. *P.H.* both parents asthmatic. *P.C.* Blood : W.B.C. 12,800, E. 66% (8,448), ruptured eosinophils seen. X-ray : lung fields clear. Sputum : *Tarsonemus*, *Tyroglyphus*, *Carpoglyphus* and *Glyciphagus* mites identified. Same mites recovered from packing materials, litter and dust of room where patient had been at work before his illness. Treatment : carbarsone 1 tab. b.d. for ten days. Clinical and hæmatological response excellent, following mild exacerbation third and fourth days of treatment (fig. 9). See also Case 100.

Case 96.—Child, aged 4, Ceylonese. Asthma, duration eight months, onset gradual, following change of residence to an old converted paper storehouse. *P.C.* Blood : W.B.C. 40,200, E. 68% (27,336). Sputum : *Glyciphagus* mites +. X-ray : ground glass haze in both lung fields, with nodal mottling in right lung (fig. 3). Treatment : carbarsone $\frac{1}{4}$ tab. b.d. for seven days, repeated after two weeks for four days. Clinical cure after first week. Hæmatological response delayed till sixth week.

Case 98.—Army ordnance store clerk, aged 35, Ceylonese. Asthma, duration thirteen years, onset gradual, following spasmodic bronchitis while working in a civilian grocery depot before mobilization. Frequency and intensity of attacks more marked during preceding year, and especially for the previous four months. *P.H.* eczema, influenzal pneumonia. *P.C.* Blood : W.B.C. 10,400, E. 14% (1,456). X-ray : lung fields clear. Sputum : *Carpoglyphus* and *Tarsonemus* mites +. Treatment : carbarsone 1 tab. b.d. for seven days. Response good. No attacks for two years.

Case 100.—Civilian entomologist, aged 58, European, resident twenty-six years in the tropics. Asthma, duration four days, following spasmodic bronchitis two weeks. *P.H.* malaria, colitis due to flagellate infection, bronchitis. For a month preceding present ailment patient had been closely examining mite-infested materials referred to in Case 95 for entomological study. *P.C.* frequent asthmatic paroxysms, mostly nocturnal, with progressive lassitude and asthenia. Blood : mild eosinophilia not exceeding 1,000 per c.mm. at any time ; mild secondary anæmia. X-ray : increased bronchiolar striations in both lung fields, most marked in left upper lobe ; slight thickening of interlobar pleura in right horizontal fissure. Sputum : *Tarsonemus*, *Carpoglyphus*, an unidentified mite, and eggs seen in three specimens. Treatment : antispasmodics and sedatives for three weeks, response unsatisfactory ; carbarsone 1 tab. b.d. for seven days. Asthma ceased third day, but general constitutional symptoms persisted for about a month, subsiding gradually with tonics, etc. Sputum re-examined after treatment showed no mites.

SUMMARY AND CONCLUSIONS

This paper is presented as a further contribution to the study of a respiratory syndrome that merits recognition as a clearly defined disease entity with a high rate of incidence in tropical countries.

- (1) An investigation of 100 cases of asthma and bronchitis associated with eosinophilia ranging between 1,000 and 50,000 cells per c.mm is reviewed.
- (2) A three-stage clinical course was recognized in 70 per cent of the cases.
- (3) The pulmonary skiagrams presented pathognomonic appearances in 45 out of 88 (over 50 per cent) of the patients examined radiologically.
- (4) Mites of at least 4 genera in various stages of their life-cycle were recognized in the sputum of 42 out of 67 (over 62 per cent) of the patients who were examined for this purpose.
- (5) An ætiological link between the clinical phenomena and pulmonary acariasis was evident in the occupation and environment of over 80 per cent of the patients, which definitely exposed these persons to inhalation of airborne mites.
- (6) No mites were found in any specimen of sputum taken from a series of 44 control cases representing patients with non-eosinophilic respiratory disorders, and healthy persons including those exposed to the same risks of mite inhalation as the majority of patients in this investigation.
- (7) A constant and effective therapeutic response was obtained in this syndrome with organic arsenicals.

The contention is not made that pulmonary acariasis is an invariable factor in respiratory disorders associated with eosinophilia. The observations here recorded, nevertheless, provide a considerable measure of support for this new orientation of the pathology of a well-recognized syndrome. Further investigation is necessary to substantiate this assumption by completely satisfying pathological criteria that arise from it, and the problem offers a fascinating field inviting exploration not only in tropical countries, but also in other lands.

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NARRATIVE OF THE MEDICAL EVACUATION OF PALESTINE COMMAND

from January 1 to June 30, 1948

BY

Brigadier A. J. BEVERIDGE

D.D.M.S. Palestine Command

GENERAL

THIS narrative deals with the Medical Evacuation of Palestine from January 1, 1948, to the final evacuation. The planning for the evacuation started in November 1947 but it did not affect the rundown of Medical Units before January 1, 1948.

There were four phases :

- 1st Phase—Evacuation of the Southern Sector (Gaza)
- 2nd Phase—Evacuation of the Central Sector (Jerusalem,
Samaria and Lydda)
- 3rd Phase—Formation of Haifa Enclave
- 4th Phase—Final Evacuation

The Medical Plan was prepared by Brigadier O. C. Link, late Deputy Director Medical Services, Palestine Command, and was adhered to—and worked with minor alterations.

Hospital provision was based on 2·5 per cent of the Force and this proved sufficient. The health of the troops was remarkably good and at no time was hospital accommodation taxed to capacity. In one instance the reduction in beds went ahead of the estimate and it was necessary to increase the British Military Hospital, Haifa, by 200 beds for a matter of three weeks till the overall reduction of the number of troops allowed a corresponding reduction in equipped beds.

The system adopted to cover the move of each hospital was to overlap a Field Force Unit (either Field Ambulance or Field Dressing Station) into the buildings of the existing hospital as the hospital moved out. The Field Force Unit then gave full Medical Cover to its formation (Brigade or Division Headquarters) until such time as that particular formation moved out. These Field Force Units were supplemented by *ad hoc* Field Surgical Units which were equipped with X-ray equipment and a blood bank sufficient to give full surgical treatment to fit the patient to move to a General Hospital. One General Hospital (including a full range of specialists) was always available in the Command. In general it was a most successful system and it was never pushed to the limits for which it was intended. No difficulties were experienced in obtaining volunteer blood donors.

HOSPITALS

On January 1 there were five hospitals in the Command giving a total cover of 1,550 equipped beds = 2·5 per cent of the Force.

These units were :

Brit. Mil. Hospital, Bir Ya'acov	..	1,000 beds
Brit. Mil. Hospital, Gaza	..	200 beds
Brit. Mil. Hospital, Haifa	..	250 beds
Brit. Mil. Hospital, Sarafand	..	100 beds
Station Hospital, Jerusalem	..	50 beds

No. 3 Convalescent Depot, Nathanya, was closed prior to January 1. Brief notes of these hospitals in the sequence in which they were reduced and evacuated :

B.M.H. Sarafand : This was always a small hospital and was housed in the buildings of the original R.A.F. Hospital at Sarafand. It has been used mainly as a Families Hospital. The Families section was moved to B.M.H. Bir Ya'acov in January. The hospital closed on January 22 and moved to Rafah, where it formed a Station Hospital Rafah.

B.M.H. Gaza : This hospital had 200 equipped beds on January 1. It subsequently closed on February 20 and moved to Egypt for disbandment on February 25, when 61 Infantry Brigade moved out of the Southern Sector. Medical cover for the few remaining troops in the area was provided by the Station Hospital Rafah.

B.M.H. Bir Ya'acov : This was always the principal hospital in the Command and was reduced to 1,000 equipped beds on January 1. It was reduced to 600 beds on February 1 and from then on gradually reduced by moving special departments (E.N.T. Orthopaedic, etc.) to B.M.H. Haifa. By March 1 it was 300 beds, and finally closed on April 12. It moved to Egypt for disbandment on April 16.

Stn. Hosp. Jerusalem : Originally equipped for 50 beds it was reduced on February 1 to 40 beds and later to 20 beds. Its main function was to act as an emergency surgical centre for Palestine Command Headquarters and for the Jerusalem Garrison. It was most successful as such and provided a full service until May 7 when it moved to Egypt for disbandment.

B.M.H. Haifa : This hospital had 250 equipped beds and was increased in February to 550 beds. This number was gradually reduced from May 20 till 100 beds remained on June 12. The unit closed on that date and proceeded to Egypt on 15th for disbandment.

HYGIENE

General.—On account of the general evacuation the maintenance of a high standard in regard to hygiene was not possible but a sufficiently high standard was maintained to prevent epidemics. Several incidents of contractors failing to fulfil their obligations for clearing garbage, etc., occurred but these difficulties were generally overcome. The only major incident was at Haifa throughout April when Jew-Arab fighting led to a complete withdrawal of Arab labour and for approximately ten days between April 20 and 30 when no Municipal Services were available. Gradually the services were restarted but in the meantime the fly breeding had started and the nuisance became almost intolerable. Coincident with this a quantity of flame thrower fuel became available for destruction so opportunity was taken to burn quantities of rubbish and garbage in situ and so sterilize the ground. Whole rubbish dumps were destroyed in this way with almost dramatic cessation of the fly nuisance.

The incinerated material was subsequently buried with the help of bulldozers. Frequent hygiene bulletins were issued through Staff Channels and hygiene slogans appeared in the Daily Newsheet.

Enteric Fever.—One outbreak of enteric fever occurred in the Acre area involving 76 cases. This outbreak started on April 22 and closed on May 16. It was mixed infection of typhoid and paratyphoid "B" (27 cases showed mixed infection). The outbreak was confined to 1 Coy. of the 2nd Battalion The Middlesex Regiment and to one section of the Palestine Police. The cause of the outbreak was due to the stopping of automatic chlorination of the Acre water supply by the Acre Municipal Authorities who did not inform their consumers of the stoppage. "D" Coy., 2 Bn. The Middlesex Regiment, were stationed at Caesar's Camp, Acre, and the Palestine Police were stationed in the Police Barracks in Acre. The total Europeans at risk were :

"D" Coy. Middlesex Regt.	107	= 65 cases = 60.74 per cent.
Palestine Police	64	= 11 cases = 17.2 per cent.
Total	171	
Total number of cases	76	= 45.5

The water supply for Acre is from natural springs at Kabri, a small town $9\frac{1}{2}$ miles north of Acre, and is brought by an old Crusader aqueduct through Jewish and Arab lands to Acre. This aqueduct was broken on several occasions by Jews and difficulties were experienced in repairing, maintaining and cleaning the aqueduct (police escorted Arab workers for the work while the Jews undertook repairs where the aqueduct passed through their lands). It is not known if the Jews did actually repair the damage but the supply of water was reduced and it was necessary to draw in a new supply from the Government Stud Farm about $2\frac{1}{2}$ miles from Acre. The municipality ran out of chlorine (cylinders) on approximately March 17, and there was difficulty in getting replacements from Haifa (Jew-Arab tension was very marked at this time with very frequent attacks on either side as well as destruction of roads). One of the results was the stoppage of chlorination of the water supply. The R.M.O. did routine bacteriological tests on April 13 and as a result of these tests gross contamination was revealed. Instructions to boil water, etc., were immediately issued but the damage was done and both Police and Middlesex Regt. were moved out of the area to a camp nearer Haifa. The M.O.H. Acre went to Beirut (his family were suffering from typhoid) and in general chaos reigned in Acre between April 20 and 30. The normal population of 25,000 was increased to 40,000 by influx of Arabs from Haifa; when it was known to the civil population that there was typhoid in the town the civilians left so that on May 10 there were only 4,500 remaining and this was reduced to 1,500 by May 15. The remainder had taken themselves off to Syria or the small villages surrounding Acre. There was no control of the epidemic amongst the civil population (Acre was outside the Haifa Enclave and so was not a Military or civil commitment of the G.O.C.) as the M.O.H. for that Area only paid sporadic visits to his Municipality. The International Red Cross endeavoured to help but got little or no co-operation from the Civil Authorities.

Malaria.—During the period there were 6 Anti-Malaria Control Units in the Command, of these four were disbanded and two moved to other Commands. The work of these units was frequently interfered with by Jew-Arab tension and on one occasion in the Acre area a unit was fired on and one of the escorts and one Arab labourer were killed and one British N.C.O. wounded.

Craforce—an independent Force—operated in the area immediately north of Tiberias as far as the Syrian border. The work of the A.M.C.U.s was very specially effective in preventing any malaria in this area. The incidence of malaria in the Huleh Area, where Craforce operated, is very high and produces malaria from April 1. Craforce was withdrawn on May 14 and during that time no malaria occurred amongst those British troops in that Area.

Suppressive mepacrine was instituted in Craforce, in Ramid David Aerodrome Area, and in Camp 190 area with *very good results*. The system of issuing mepacrine through the supply points with the rations was adopted and checks were instituted regarding the consumption of mepacrine with a view to preventing waste. These checks were effective in bringing to light defects in units administration and also controlled consumption of an item which has a highly saleable value.

In the Kurdani Area, immediately north of Haifa (an extensive swamp area), heavy breeding of the four usual types of malaria-carrying mosquito were found. Twenty-seven cases of malaria occurred in the Command during the period of which only one was fresh infection, twelve of the relapses were in Mauritian troops.

D.D.T.—12,500 gallons D.D.T. residual spray were issued to various Local Authorities in the Haifa area between May 15 and June 30 on repayment.

EVACUATION OF PATIENTS FROM PALESTINE

No great difficulties were experienced regarding evacuation but it was necessary to have one medical officer trained as an embarkation medical officer. This officer acted as E.M.O. at Haifa till the end of the evacuation and proved a great asset.

A. Independent Ward Coaches.—I.W.C.s continued to operate from Lydda to Kantara on the daily mail train until March 26. Only on one occasion, during the last week of January, was it necessary to use more than one coach a day. During that particular period six coaches were despatched in one week. Two on one day. The total number of patients evacuated by train was 465.

B. Hospital Ships and Troop Ships.—When it became evident about mid-March that evacuation by train would cease to operate it was decided to evacuate all suitable cases by troopship to Egypt or to U.K. In addition there were three lifts by Hospital Ships up to June 15. After that date the Hospital Ship "Oxfordshire" remained at Haifa as a floating hospital until the final evacuation. The total number of patients evacuated by this method was 878.

C. Evacuation by Air.—Three cases were evacuated to Egypt by Air and eight cases (Arab Legion) to Amman. The total number by air = 11.

Air evacuation was used on three occasions in Palestine to evacuate surgical cases to the main surgical centre.

The total number by all means = 1,354.

Motor Ambulances.—There were 390 Motor Ambulances in the Command on January 1. As each formation left the Command it took the full W/E of Motor Ambulances with its Medical Unit to the new destination. By June 1 the number of ambulances was reduced to 28 (including 14 for No. 35 Field Ambulance). One ambulance had to be destroyed by fire during the evacuation from Jerusalem—it became a non-runner and towage of such vehicles was not permitted. All ambulances were evacuated by June 28, 1948.

Terrorist Activity.—The total number of casualties resulting from terrorist activity admitted to hospitals during the period were 456.

CIVILIAN DETAINEES

Up to May 15 the medical care for all civilian detainees was a responsibility of the Government of Palestine. After that date it passed to the Military Medical Directorate when 121 detainees were taken over. Several attempts were made by the Jewish Agency to obtain release of these detainees on medical grounds. In order to obviate complaints of this nature a Medical Board of Specialists was held on May 9 when all chronic medical cases were examined and directions regarding treatment, etc., given. On June 1 the number of detainees was reduced to twelve and these remained a military medical responsibility till the end of the evacuation. No difficulties were experienced in carrying out this commitment.

FOOD SUPPLIES

Normal supplies were maintained until the move into the Haifa Enclave, after which difficulty was experienced in maintaining fresh vegetables and eggs. The prices of these items rose rapidly till they reached a peak of 14 times normal. Small quantities of vegetables were imported from time to time from Cyprus and Egypt; tinned vegetables were supplied when fresh items were not available. Fresh meat, potatoes and fruit were available throughout the whole period. It was unnecessary to issue compound vitamin tablets at any time.

STORES

Accommodation Stores of Medical Units were returned to the nearest Barrack Store.

G 1098 Stores.—Units moved to Egypt or other Commands with their G 1098—any items surplus were returned to the nearest Ordnance Depot.

Medical Stores were all returned to G.H.Q. Medical Stores in Taka. In general the system worked well and the various stores reached their correct destinations.

The amount of *Medical Stores evacuated* = 1,148 tons.

PROVISION OF HOSPITAL ACCOMMODATION

In planning the evacuation a requirement of 2.5 per cent beds with a 60-day holding policy for the force was accepted. In February this requirement was reduced to 2 per cent—this figure was not always adhered to as the static installations moved out of the Command and the Field Force Units provided sufficient medical cover. The average occupied bed state never exceeded

1.47 per cent so there was always at least 25 per cent beds available, an indication that there was a slight over-insurance if anything. To offset any question of under-insurance the time factor for evacuation of cases to Egypt was only twenty-four hours and Field Force Units were never used to full capacity.

HOSPITAL BEDS EQUIPPED AS % OF STRENGTHS

<i>Month</i>	<i>Average monthly strength of the Command</i>	<i>Beds equipped as on 1st of each month</i>	<i>% beds</i>
January	61,360	1,550	2.53
February	52,695	1,070	2.03
March	48,812	921	1.89
April	42,281	571	1.35
May	25,488	336	1.32
June	8,960	250	2.79

HOSPITAL BEDS OCCUPIED AS % OF STRENGTHS

<i>Month</i>	<i>Average monthly strength of the Command</i>	<i>Beds occupied as on 1st day of each month</i>	<i>% beds</i>
January	61,360	900	1.47
February	52,695	731	1.39
March	48,812	504	1.03
April	42,281	291	0.69
May	25,488	234	0.92
June	8,960	117	1.31

MEDICAL STATISTICS AND COMMENTS THEREON

ADMISSIONS TO ALL TYPES OF MEDICAL UNITS (RATIO 1/1,000)

ALL CATEGORIES OF TROOPS — COMPARATIVE FIGURES 1947 — 1948

<i>Disease or injury</i>	<i>January</i>	<i>February</i>	<i>March</i>	<i>April</i>	<i>May</i>	<i>June</i>
	<i>Adms. R/1000</i>	<i>Adms. R/1000</i>	<i>Adms. R/1000</i>	<i>Adms. R/1000</i>	<i>Adms. R/1000</i>	<i>Adms. R/1000</i>
Dysentery	47 18 0.26	15 0.21	125 1.63	236 3.00	195 2.39	181 2.16
(All types)	48 22 0.36	20 0.38	8 0.16	9 0.21	36 1.41	18 2.01
Enteric fever (all types)	47 1 0.01	— —	1 0.01	4 0.05	28 0.34	10 0.12
	48 2 0.03	2 0.04	4 0.08	32 0.76	35 1.37	— —
Malaria (all types)	47 27 0.38	19 0.26	32 0.42	27 0.34	26 0.32	37 0.44
	48 9 0.15	4 0.08	3 0.06	2 0.05	3 0.12	7 0.78
Veneral disease (all types)	47 99 1.41	80 1.10	87 1.14	68 0.87	79 0.96	66 0.79
	48 46 0.75	35 0.66	22 0.45	13 0.31	13 0.51	4 0.45
Injuries (all types)	47 398 5.64	326 4.47	428 5.60	287 2.51	356 4.37	274 3.27
	48 301 4.91	320 6.07	309 6.33	253 5.98	146 5.73	38 4.24

ADMISSIONS TO ALL TYPES OF MEDICAL UNITS
ALL DISEASES

	1947		1948	
	<i>Adms.</i>	<i>R/1,000</i>	<i>Adms.</i>	<i>R/1,000</i>
January	2,111	29.91	1,533	24.98
February	2,055	28.20	1,298	24.63
March	2,445	31.97	1,074	22.00
April	2,421	30.82	695	16.44
May	2,660	32.62	522	20.48
June	2,609	31.14	191	21.32

AVERAGE CONSTANTLY SICK
ALL CATEGORIES OF TROOPS

	1947		1948	
	<i>Av. Const. Sick</i>	<i>R/1,000</i>	<i>Av. Const. Sick</i>	<i>R/1,000</i>
January	1,234.47	17.49	832.00	13.56
February	1,355.27	18.60	764.00	14.50
March	1,385.20	18.11	515.25	10.56
April	1,452.73	18.49	260.60	6.16
May	1,488.10	18.25	223.00	8.75
June	1,446.00	17.26	65.29	7.29

The average hospital admission rate and the average constantly sick rate per 1,000 compare very favourably with the corresponding rates over the same period in 1947—there is a slight increase in the figures for dysentery during January and February which is followed by a marked decrease in the following months. Towards the end of the operation the admission rate for diseases fell to half the expected rate and the average constantly sick to nearly one-third of normal. The malaria figures are specially creditable and indicate a high standard of malaria discipline in units. Credit must be given to “suppressive mepacrine control” where it was applied and to the excellent work of the anti-malaria control units.

Enteric fever has already been mentioned and the marked increase in figures is due to one isolated incident in April and May. The incidence of venereal disease has always been low in Palestine over the past three years and this is partly due to racial animosity and that opportunities for infection were not available in that troops were confined to barracks or zones after nightfall.

It is the impression of medical officers that the high state of morale of the troops under operational conditions discouraged the average other rank from reporting sick until they could carry on no longer. Previously a trivial cut or abrasion which would appear on sick parade was now delayed until it was an advanced whitlow. To this must be added the anxiety on the part of all ranks to leave Palestine with their units.

The spirit and physical fitness of the troops was an inspiration to all.

One cannot close this narrative without a tribute to all members of the Medical Services for their devoted attention, treatment and nursing of all those that came under their care.

THE MIDDLE EAST CHEST UNIT

BY

Major R. D. W. SCHOFIELD

Royal Army Medical Corps

(late Officer i/c Chest Unit, M.E.L.F.)

THE history of the Middle East Chest Unit is worthy of record for a double reason : first, because it is the story of a unique and successful venture in military medicine, the benefits of which were reflected not only on the soldier serving overseas, but also upon the civilian patient and the chest hospitals at home ; secondly, because the experience gained will prove of lasting value from both the clinical and administrative viewpoint.

The Unit was established in May 1943, at the 16th General Hospital, Jerusalem. Occupying the palace built by the Kaiser on Mount Scopus, the situation was idyllic, overlooking the Holy City to the West, and Eastwards commanding an uninterrupted view across the Wilderness of Judæa to the Dead Sea and the mountains of Transjordan. The hospital was 2,640 feet above sea-level, and the climatic conditions were ideal for a sanatorium, as neither temperature nor humidity tended to be extreme. True, the winter could be bitterly cold and wet, but this was a drawback for the staff rather than for the patients.

In this site, the 16th General Hospital, later known as the British Military Hospital, Jerusalem, acted as the Middle East Chest Centre until July 1947, when the remaining patients were evacuated to U.K., a total existence of just over four years. During this period the hospital also dealt with the routine medicine and surgery from the area but, in the later days, a progressive shortage of staff limited the general work to short-term medicine and emergency surgery, all other cases being transferred to the 12th General Hospital at Bir Ya'cov. The operative procedures required for the chest patients were normally carried out by the Surgical Division of the hospital. However, in the early days of 1944, the No. 1 Surgical Chest Team was attached. This Team carried out its work as a theoretically independent unit until its disbandment on May 5, 1946, when the members of the team were assimilated on the hospital staff.

Staffed by specialist chest physicians and surgeons, the Centre treated all long-term or serious thoracic diseases arising in the British Forces in the Middle East, including the Palestine Police. There was, however, an additional commitment, as non-British patients requiring thoracic surgery were trans-

ferred to Jerusalem from the Mixed Hospital at Qassasin and the No. 8 Polish General Hospital at Kantara. In November 1945 the Mixed Hospital disbanded, the Italian section moving to the 12th General Hospital, and the Indian to the 22nd Indian General Hospital but, as both of these were situated in Palestine, the medical care of tuberculosis and other chest diseases could then also be supervised by the Chest Unit specialists.

The value of the Unit was greatly enhanced by the co-operation of the South African medical authorities who made the Military Hospital at Baragwanath, near Johannesburg, available as a sanatorium for British personnel. This became the destination for those cases of pulmonary tuberculosis who were considered curable by a prolonged period of sanatorium régime. Should active collapse therapy be indicated this was instituted and stabilized at Jerusalem before evacuation to South Africa, so that all cases arriving there were presumably improving. Those cases in which the extent or inexorable spread of the disease indicated a grave prognosis were, of course, evacuated home. So also were patients requiring thoracoplasty, which was only undertaken on very urgent indications in British personnel. As a general rule, cases of pleural effusion were also sent directly to the U.K. I have found records of 555 cases of pulmonary tuberculosis being evacuated to South Africa between January 1944 and June 1946, when the scheme was discontinued, an impressive contribution to the long-term treatment of the disease.

During the total period of its existence, 2,568 cases of tuberculosis and pleural effusion were admitted to the Chest Unit, this figure including Allied personnel who were accepted for surgical procedures. Artificial pneumothorax was undertaken in 585 cases, and thoracoscopy with attempted adhesiotomy was performed on 486 occasions. These two figures cannot be proportioned, as the latter includes cases of A.P. induced elsewhere and subsequently admitted for adhesion section, but experience showed that about 75 per cent of those cases which were initiated at Jerusalem required thoracoscopic intervention before a stable and effective collapse was obtained. Out of the last 238 A.P.s attempted, 192 or 81 per cent were successful, the remainder failing owing to varying degrees of pleural fusion. Complete figures are not available for other forms of collapse therapy but, during the period between April 1945 and June 1947, thoracoplasty was undertaken on 52 patients, phrenic nerve operations on 111, and pneumoperitoneum induced on 32.

One of the most useful functions of the Chest Unit, from the point of view of the other hospitals in the Middle East, was the specialized investigation of "doubtful" cases. Thus, over the last two-year period, 20 cases of unexplained hæmoptysis, and 74 presenting other symptoms of uncertain significance, were admitted for observation and disposal. In addition, the activities of the Surgical Team were not confined, of course, to the treatment of tuberculosis. For example, during the year 1946, bronchoscopy was performed 33 times, empyema or lung abscess drainage undertaken on 27 patients, and pericardectomy, lobectomy, and pneumonectomy undertaken once each.

In applying the experience gained by the Chest Unit, it is necessary to consider the approximate incidence and mortality of pulmonary tuberculosis in the Army. It was found that over the whole Command, and in British troops, the sickness rate for this disease during the four years 1943-1946 averaged 0.91 per 1,000 per annum, the highest figure being 1.01 in 1945. In 1947, however, there was a very significant increase to over 1.3 per 1,000, presumably accounted for by the large percentage of young soldiers serving overseas who had been brought up in wartime conditions. Hence, whilst the condition is relatively rare, and whilst the number of cases to be expected in a smaller peace-time army is not great, it is apparent that the continuance of conscription will result in the disease being a more serious problem than in pre-war days, owing to large number of youths in a very susceptible age-group serving for short periods. But, whilst the incidence of tuberculosis is not unduly high, the mortality rate is ominous. Out of 997 cases occurring in British troops serving in the Middle East during the five-year period 1943-47, there were 46 deaths, or 4.6 per cent, despite the fact that all patients whose prognosis appeared hopeless were evacuated home at the earliest opportunity. This figure represents an average of 7 per cent of all "medical" deaths occurring in the Command, and would undoubtedly have been much higher but for the temperate climate and excellent facilities available in Jerusalem. It is also possible, of course, that many of the advanced cases who reached U.K. safely may have died shortly afterwards. To reduce this heavy mortality, the following points are of prime significance :

(1) Earlier diagnosis in the M.I. room. With pathetic regularity cases were received of gross and incurable disease who had previously reported sick on one or often numerous occasions for symptoms of such moment as hæmoptysis, and who had been returned to duty without investigation. It cannot be too strongly emphasized that clinical examination of the chest is not enough, as the majority of early cases of tuberculosis, and a high percentage of advanced ones, are seen and not heard. All patients who complain of progressive loss of weight, of pleuritic pain, or merely of chronic ill-health, apart from the more obvious symptoms, and particularly when associated with a family history of this ailment, should be referred to a hospital for radiological examination at the earliest opportunity.

(2) Cases of acute tuberculosis, with marked toxæmia, should not be moved in too great a hurry. Collapse therapy is not normally indicated until the toxic phase is subsiding, and therefore it is far better that the patient should have a period of strict bed-rest when first diagnosed, rather than be immediately subjected to the strain of a long journey in order to reach a special chest centre.

(3) For those few cases where urgent collapse must be performed, as for example severe and repeated hæmoptysis, it is highly desirable that facilities should also be available for thoracoscopic intervention if required. Otherwise, the presence of a large, thin-walled cavity held taut by adhesions may make the journey homewards more precarious than if nothing had been done at all.

When the services of a thoracic surgeon are not available, my own feeling is that the advancing disease is better tackled by a phrenic crush and pneumoperitoneum, rather than a pneumothorax. The improvement thus produced will be very variable both in degree and in duration, but in many cases it will be adequate to render the subsequent evacuation to a chest centre a much less hazardous undertaking.

I am indebted to Major-General F. Harris, *C.B.E.*, *M.C.*, *M.B.*, *K.H.S.*, Director of Medical Services, *M.E.L.F.*, for permission to publish this account ; to Brigadier D. C. Monro, *C.B.*, *C.B.E.*, *M.B.*, *F.R.C.S.(Ed.)*, Consulting Surgeon, *M.E.L.F.*, who kindly placed the surgical records at my disposal ; and to Brigadier C. G. Parsons, late Consulting Physician, *M.E.L.F.*, for a wealth of advice and helpful criticism.

THE CAUSES OF DISEASE IN THE SIXTEENTH CENTURY ARMY

BY

DAVID STEWART

IN an earlier paper it was shown that, although the sickness and mortality rates in the English armies of the sixteenth century were high, they do not appear to have been much worse than similar rates in subsequent centuries. Little improvement occurred, or indeed could occur, until sanitary knowledge had been placed upon a scientific basis ; and until bacteriology had advanced sufficiently to devise means of protecting individual soldiers by raising their resistance to the commoner diseases of military life.

During this long period, stretching from the sixteenth to the middle of the nineteenth century, many thinking men and conscientious soldiers, realizing that the health of the soldiers was unsatisfactory, had done what they could to ameliorate the lot of the soldier and to reduce the dreadful wastage from disease. Such men as these attempted to ascertain the causes for these high rates of morbidity and death and came to various conclusions as to why they were so severe.

In the sixteenth century numerous suggestions were put forward to explain the causes for this wastage. Complaints were made of the poor quality of the men enlisted into the Army. For this the medical service was in no wise to blame, as the recruits were not medically examined on entering the Service. Recruitment was partly voluntary, but the numbers obtained in this way were normally insufficient to fill the ranks, and compulsion had to be resorted to, to bring the Army up to strength. This gave unscrupulous captains and other officials opportunities of making money, and of cheating the State by recruiting men unfit for service. The classical description of how this was done will be found in Shakespeare's *Henry IV*, act IV, scene 2, where Falstaff gives an account of how he recruited his company of foot for service with the king. In the first place he impressed well-to-do householders, the sons of yeomen, those about to be married, and others of a similar type who, although highly respectable, had not the slightest desire to be dragged off to serve in the wars. These Falstaff released from service on the payment of a couple of pounds apiece, which he pocketed. To fill their places he enlisted tramps, rogues, and poor undernourished men, who could not afford to pay him off. The final result was that he had "a hundred and fifty tattered prodigals," of whom he was so ashamed that he marched them round Coventry to avoid the town, as he dared not let the people see that a pitiful collection of humanity he had gathered together.

It was the custom of the authorities of a county, when ordered to make a levy for the Army, to round up all the rogues and vagabonds at large in the district, and to release criminals from the gaols to fill up their quota. This had

the twofold advantage of relieving respectable citizens of an unpopular duty, and of freeing the county of a large number of objectionable characters who were liable to be a nuisance and an expense to those in authority. The county was also largely responsible for arming, equipping, and clothing the men that they had recruited. As this was a direct charge upon the locality, for which it saw little in the way of return, the local authorities tended to skimp this duty, and the men were sent off on active service badly armed and worse clothed.

It is, therefore, not surprising that commanders complained of the poor standard of the recruits that were sent to them, and the badness of their dress and equipment. Nor is it surprising that it was generally believed that new recruits were more susceptible to disease than soldiers with longer service.

In 1581 the Lord Deputy of Ireland protested against "the evil choice of men" sent to that country, and expressed the hope that the next batch of recruits would be of a higher standard (Salisbury, II, pp. 384-5). Later in the same year he complained that "the new men fall sick daily" (CSPI, 1574-85, p. 311). The soldiers sent to the Continent in 1588 from Sussex were badly equipped in every respect (CSPD, 1581-90, p. 261). That year most of the troops in the garrison at Ostend were thoroughly seasoned soldiers, and well equipped. To this was assigned that high standard of health among the garrison of that town. But at the same time there were present at that place four companies of immature youths, who were said to feel the effects of the cold autumn, and to "fall lame and sick and die like unsound sheep" (CSPF, Jan.-Dec., 1588, p. 366). The troops levied in Somerset for service with Sir John Norreys so impressed that officer, when he saw them at Portsmouth, that he said that half of them were the worst men and the most poorly equipped soldiers that he had ever inspected. He had to leave a great number of them behind, because they were physically too weak to stand a sea voyage (CSPD, 1591-4, p. 26).

In 1597 the Lord Deputy of Ireland wrote :

"The causes of all decay amongst us is the the ill-choice of men, who come so wretched as they be half-dead when they first land, and many such silly creatures as die for fear" (CSPI, 1596-7, p. 399).

The drafts sent to Ireland in December 1598 seem to have been rather above the average in quality and to have been well equipped; they were, however, quite raw, and without any training. This is about the only occasion when a good word was said for the recruits sent to Ireland. In February 1600, Lord Mountjoy, on the way to that country, was informed at Chester that the soldiers passing through that city were quite unfit for service (CSPI, 1599-60). The troops sent over to the siege of Kinsale, in the winter of 1601, were of the usual low standard. Few of them knew how to handle their weapons, or how to look after themselves in the field. Lord Deputy Mountjoy felt compelled to send one thousand of them off to Cork, so that they could have buildings to live in; otherwise he believed that he would have lost most of them from exposure before they could have built huts to protect themselves from the weather (CCP, 1601-3, p. 164). Despite these precautions the greater

part of them were lost to the Army, partly through disease, and the remainder by desertion (*Ibid.*, p. 195).

When all these examples are taken into consideration, it is not to be wondered at that military men were of the opinion that newly joined men were less capable of withstanding the rigours of Army life than those who had undergone these hardships and had become inured to the conditions which arise on active service. Captain Baynard said that the soldiers in Ireland, who had recovered from the disease of that country, were three times more valuable than other troops for service in that country (CSPI, 1599-60, p. 350). Sir Patrick Barnewall stated that new troops were quite useless in the Lough Foyle district: before they could be trained they fell sick; then they either died or were evacuated to England. In either case they were lost to the Service before they became of any value. He also believed that a man who had been sick in Ireland, and had recovered, was three times as valuable as a new recruit (CSPI, 1600, p. 341).

One of the commonest causes assigned for the unhealthiness of the troops was the unsatisfactory state of their pay. Either it was insufficient, or it was so much in arrears, that they were unable to keep themselves in food, and consequently starved. The complaints about the poor rate of pay are confined to the earlier part of the century, and those about arrears to the latter part of it, during the reign of Queen Elizabeth. This monarch was never overburdened with money, and always had difficulty in finding sufficient means to meet her obligations. In the matter of pay for the troops she was further handicapped by the corruption of her military officers, who misappropriated for their own use money intended for the soldiers. These officers, having done this, frequently had the impertinence to complain about the hard conditions under which their men were living for the want of money.

That the soldier should be regularly paid was even of more importance in the sixteenth century than it is at the present day. He had to buy his own rations, as they were not supplied to him by the government. Individuals, as a private speculation, laid themselves out to supply the troops with what they might require in the way of food. Towards the end of the century things became better organized, and the right to supply the troops was given out to contract to certain selected persons. In this way government was able to exercise some control over those who supplied food to the troops, and to see that the provisions were up to a certain standard of wholesomeness. But whether the soldier bought his rations from a private trader or an official contractor, he was quite unable to do so if he did not receive his pay at regular intervals. As this was frequently many months in arrears, there were often bitter complaints of the troops being starved; and for that reason suffering greatly in health.

It is unnecessary to consider all of the numerous references to the hardships arising from the irregular issue of pay. They occur throughout the whole of the period beginning with 1512, when the soldiers at Fontarabia complained that they could not live on their wages on account of the scarcity and high cost of victuals (LPH, VII. p. 396); and at the end of the period on

December 10, 1600, when Lord Deputy Mountjoy declares that he has not enough money to look after his troops (CSPI, 1600-1). Towards the end of the century, however, the complaints about the lack of money became less frequent, and their place was taken by grumbles about the quality of the rations supplied by the contractors. This probably arose from the fact that the soldier, instead as heretofore being able to obtain his supplies from several sources, was now confined to one contractor. That worthy, having no competition to meet from rival firms, no doubt often took advantage of his position and cut down the standard of his goods.

As was to be expected, many experienced officers considered that the men's rations were largely responsible for many of the ills of the Army.

An early complaint on this ground comes from Ireland. In August 1548, Plunket and Allen reported to the Lord Deputy that the soldiers in Dublin were likely to perish for want of food (CSPI, 1509-7, p. 84). In November 1584, Captain Morrys said that the troops employed upon the fortifications at Antwerp, and at Burgerhout, had nothing to eat except cheese and bread. For want of meat they were killing and eating cats and dogs (CSPF, 1584-5, p. 151).

The English soldier had to have his butcher's meat, and if he did not get it, he resorted to this practice. Indeed, during the Commonwealth period, and especially in the West Indies, the slaying of cats and dogs by the soldiers for food became so common that the Spanish imagined that the English preferred the flesh of these animals to beef and mutton.

In 1587 one-third of the soldiers at Flushing were sick on account of their not having enough money to buy food (CSPF, 1587, p. 340). Sir Thomas Norreys, writing from Cork to Sir Robert Cecil, mentioned that, although he had done his best to preserve his men, they had deteriorated seriously from sickness. He said that his officers believed that the cause of this was the smallness of the ration, and its inferior quality; if improvements were not made the force would be completely ruined (CSPI, 1598-9, p. 466). In the following year Carew wrote from Dublin that it would be a great comfort if the sick soldiers had fresh bread and meat instead of mouldy and rotten biscuits, cheese, fish, and "ristie butter, which doth breed much sickness and disease amongst the soldiers" (CSPI, 1599-1600, p. 97).

One could go on multiplying examples of a similar nature, but sufficient has been said to show that it was firmly believed that one of the principal causes of the unhealthiness of armies was the shortage of rations and the poorness of their quality.

Up to now we have not discussed the effects on the men of the drink that was issued to them. It was generally considered that the English soldier, if he were to remain healthy, had to have his beer regularly, and in adequate quantities: if he did not get it he went sick. A curious example of this belief comes from Havre, just at the time of the outbreak of the plague in that town. Kemys expressed the opinion that the epidemic was due to the fact that the soldiers, on account of the shortage of beer, had to drink wine (CSPF, 1563, p. 94). And the same doctrine was even more clearly enunciated by no less a

person than the Queen herself. In some instructions to the Lord Deputy and the Council In Ireland she writes :

" Forasmuch as there is no provision of beer made for the garrison at Lough Foyle, and that the soldiers there, by continual drinking of water, cannot but be made weak of their strength, which will hinder their service " (CSPI, 1600, p. 278).,

Clothing, or rather the lack of it, was another important factor in the causation of disease among the troops. Any reader interested in this matter will find the system of supply of these articles described fully in C. G. Cruickshank's " Elizabeth's Army " so that there is no point in going over the same ground again in this paper. Suffice it to say that there is not the slightest doubt that it was frequently highly unsatisfactory : the clothing arrived long after it should have done, and was of poor quality ; the result being that the soldiers were often in rags and almost without any clothes at all.

Clothing, however, is not generally put forward as a sole reason for the unhealthiness of the troops, but there is an example of this from Mallow, where the inefficiency of the older soldiers was assigned to the want of clothing (CSPI, 1659-60, p. 129).

Climate and the weather were looked upon as the most potent causes of disease in the English armies. The English soldier was evidently thought to be a rather tender plant, that did not take kindly to any other climate than that of his native land. The position is well described by Cruickshank in the following passage :

" The climate of the countries where they served was responsible for much of the sickness among Elizabeth's soldiers. France and Portugal were too warm for Englishmen, while Ireland was too cold. It was suggested in some quarters that proper precautions had not been taken against disease in Portugal, but one of the men who had been there indignantly refuted the suggestion. He pointed out that strange climates had always taken heavy toll of the English forces. The raw, cold air in the Netherlands had been too much for them, and had caused many deaths even when the men were in billets. The warmth of France aided by the abundance of fruit and wine, to which Englishmen were unaccustomed, had always undermined their health. In any case, even when the Spaniards campaigned in the summer months they could not avoid heavy losses owing to sickness " (pp. 126-7).

The above quotation is based upon Wingfield's defence of the authorities responsible for the Portuguese expedition, but much the same sort of thing was said during other campaigns. The climate of Ireland was considered to be especially accursed.

As far back as 1522, the weather in France was blamed by Wolsey for the large number of deaths among the troops. But on this occasion it was not the heat of the country that was blamed for the trouble, but its extreme coldness ! (SP H VII, vi, p. 233.) Norfolk, in 1544, described the weather of that country as being so terrible in September that it was impossible for the men to work in the trenches (LP H VII, xix, pt. 2, p. 133). In 1596 there were bitter complaints about the climate of St. Valery (Salisbury, vii, pp. 39, 45, 70) and this was blamed for causing sickness among the troops stationed at that place. But in an earlier paper it has been shown that the soldiers at St. Valery were not unhealthy, so, however severe the weather may have been, it was not responsible for any outbreak of disease among the English Army there.

The Low Countries were equally unfavourable to the health of English troops. At Flushing in December 1585, death and disease was believed to have been due to the "noisome air of the place" (CSPF, 1585-6, p. 206).

But it was the climate of Ireland that was responsible for the greatest outreries from military men. It was requested in March 1567 that the force at Derry should be removed to Strangford Lough on account of the weather being so cold at the former place (CSPI, 1509-73, pp. 328-9).

At the end of August 1600 the weather at Derry is described as

"already grown wonderful stormy, even such as no man can conceive that feeleth it not" (CSPI, 1600, p. 380).

Also Captain Dawtry, in October of the same year, writing to Cecil, remarks :

"The weather for the time of twenty days fell out so extreme, as I never saw the like this thirty six or thirty seven years. For I will protest that in twenty days I could never say that all the clothes on my back were dry" (CSPI, 1600, p. 531).

And finally an observation of Carew from Cork, on January 22, 1602, when he says :

"The sharpness of this winter's journey hath tried the strength of our companies, but the mountains of Beare being at that time covered with snow, testing the strongest bodies, whereby many returned sick, and some (unable to endure the extremity) died standing sentinell. And that which much weakened them was their ill victualling, consisting mostly of poor-John (coarse fish, D.S.) and no other drink but water" (CCP, 1601-3, p. 405).

and so the complaints about the climate of Ireland went on.

Now we know perfectly well that there has been no great change in the climate of Europe during the past three hundred years ; and that our troops have served time and time again in these various countries ; and that the climate of these places has, at the very worst, been no more inclement than that of England. It is therefore hard to believe that the Elizabethan soldier was not as well able to withstand the rigors of these strange climates as his descendant of latter days. It would appear that these outreries against the weather of other countries were merely subterfuges put forward to explain away the outbreaks of disease in the armies, the real causes of which were unknown.

It is true that the troops in England did not appear to suffer to the same extent from disease, but the reason for this is obvious. What soldiers there were in England were few in number, living in small scattered garrisons, far removed from the conditions found on active service. For a long period, over a hundred years, there had been no active campaigning in England itself ; if there had, it would soon have been discovered, as it was half a century later during the Civil War, that the English weather was just as unfavourable to the English soldier on active service as the strange exotic climates of France, Holland and Ireland.

If military officers of experience were wrong in thinking that the climate of the different countries, in which the English soldiers fought, was responsible for their poor health, were they more correct in their other suggestions ? Was it the poor quality of the recruits, the irregularity in the issue of pay, the

poorness of the rations, and the indifference of the men's clothes and equipment, that was responsible for the high rate of sickness that always followed armies on active service? Though it cannot be denied that these factors have a definite influence on morbidity and mortality rates, their effect was grossly exaggerated.

As the years passed, the administration of the English, and later the British Army, improved. Men of better stamina were enlisted; generals arose who took an interest in the welfare of their troops, and who saw that the men's rations and clothes were properly and regularly supplied. Yet despite all this care, during the following two and a half centuries, there was little improvement in the health of the British Army when it went on active service. Wellington was a genius in military organization and administration, but even he, less than one hundred and forty years ago, could not reduce the numbers permanently sick in the Army under his command to less than 22½ per cent.

All precautions such as these were unavailing; and to return to the opening paragraph of this paper, little improvement in the health of armies could be expected until medical science had discovered the causes and the means of preventing those diseases which are most prevalent among soldiers in the field. Once this happened, generals were faced with a new problem; they had now either to kill or capture the forces of their enemies, instead of, as in the good old days, waiting for these forces to perish from disease.

KEY TO REFERENCES

CCP	Calendar Carew Papers.
CSPD	Calendar State Papers. Domestic.
CSPF	Calendar State Papers. Foreign.
CSPI	Calendar State Papers. Ireland.
LPH VIII	Letters and Papers Henry VIII.
SP H VIII	State Papers Henry VIII.
Salisbury	Salisbury Papers: Historical Manuscripts Commission.

Clinical and Other Notes.

**INTERNATIONAL COMMITTEE ON MILITARY
MEDICINE AND PHARMACY**

BY

Lieutenant-Colonel M. H. P. SAYERS

Royal Army Medical Corps

THE International Committee on Military Medicine and Pharmacy was set up after the first World War with the object of bringing together members of the Medical Services of all nations so that they might co-operate for the common good of the soldier in peace and war.

Between the two wars meetings were held every two years in different countries and were attended by representatives of the Medical Services of the Navy, Army and R.A.F. Some may remember the meeting held in London at the R.A.M. College in 1929. The Office of International Documentation was set up in Belgium to act as the central office for the committee and to collect a library of official medical documents and journals of the different nations. It published a periodical bulletin. The office premises were completely destroyed during the war and a collection got together during more than twenty years was lost.

The first meeting of the Committee after the war was held in January 1945 in Brussels. In the circumstances only a few nations were represented and these comprised delegates from the U.S.A., France, Great Britain, Switzerland and Belgium. It was resolved to resume the activities of the committee, to reconstitute the collections of documents destroyed during the war and to continue publication of the committee's periodical "The International Bulletin of the Army Medical Services."

Further reunions of the committee took place in November 1945 at Brussels and in April 1946 at Berne when arrangements were made for the Eleventh Congress to be held at Basle in 1947.

Delegates from 39 nations were present at the Basle Congress and Britain sent nine official delegates, four from the Army headed by the late Director-General, three from the R.A.F. and two from the Navy. Lt.-Gen. Sir Treffrey Thompson led the delegation from India, while Canada, Australia and South Africa were also represented.

Among a number of interesting papers was one by the Consulting Surgeon to the Army, Brigadier Fettes, on "Methods of Resuscitation of the Wounded." and one by the Professor of Hygiene, Colonel Kennedy, entitled "Prophylactic Methods adopted in the Army to deal with Epidemic Diseases."

The Swiss Army Medical Services staged an excellent demonstration on rescue of casualties from mountainous country carried out at 8,000 to 10,000 feet in snow, which showed what could be achieved by a high degree of training. Not the least value of the conference was the friendly contacts made between the leading personalities of the medical services of the different nations.

In August of 1948 a further reunion, attended by representatives of 20 nations, including Spain, was held in Stockholm, immediately preceding the 17th International Red Cross Conference. One of the main purposes of the meeting, which lasted two days, was to arrange for the 12th Congress of the Committee, which it was decided would be held in October 1949 in Mexico.

The first day's session was held in the majestic Swedish Government Buildings at which very lengthy discussions took place on the question of the status of "protected" personnel under the Geneva Convention, which is now undergoing revision. The realistic proposals recommended by the Committee of Government Experts at Geneva in April 1947 and sponsored chiefly by Canada, Great Britain, U.S.A. and Holland, by which hitherto "protected" personnel should be regarded as prisoners of war, if captured, were vigorously opposed by the majority of the delegates. A resolution was passed seeking to restore the position of protected personnel to that of the 1929 convention although these provisions had not been found workable in two World Wars.

There were discussions on the standardization of medical equipment, and it was agreed that a committee which had been studying the subject for the past twenty-odd years should resume its functions. The need for standard blood transfusion equipment was particularly stressed. The Swiss delegate recommended that the field medical card should be standardized—a proposal which might be difficult for us to implement in view of the statistical information obtained therefrom.

The first day was concluded by a paper read by the Secretary-General, General Voncken, on the conduct of doctors in war, emphasizing the need for an international convention governing the things a doctor could or could not be called upon to do. This paper was inspired by the reported experimentation on human subjects carried out in certain concentration camps during the last war.

The meeting on the second morning was devoted to scientific papers and was held at the Sodersjukhuset, probably the most modern and best equipped hospital in the world, which was completed in 1944. General Lindsjo, the Director-General of the Swedish Medical Services, read an interesting paper on B.C.G., which is in routine use in the Swedish Army, and the various delegates described the attitude of their Medical Services to the problem of the diagnosis and prevention of tuberculosis. M. Börje Alm, Pharmacist-in-Chief to the Swedish Forces, described the organization of Army pharmacy in Sweden. There were also interesting lectures and demonstrations on the production and use of "Dextran."

The rest of the time was taken up with liberal entertainment. The kindness and friendliness of the Swedish people was apparent everywhere and made a profound impression. The wealth of goods of British manufacture in the shops revealed what the export drive looked like at the receiving end, while the abundance of good things to eat and Schnapps to drink reminded one of what General Hood had said on his return from Basle last year: "We in this country," he said, "had forgotten what a decent meal was like."

The last evening was taken up with an excursion by motor launch up the

river to Saltsjobaden where we were entertained to a magnificent dinner. The beauty of the capital earned a happy tribute from General Ferri of the Italian Medical Services, who likened it to a "large edition of his own lovely Venice"—a tribute which we all thought fair enough.

NOTES ON A SMALL EPIDEMIC OF PARATYPHOID "A" FEVER

BY

Captain S. COPE, M.D.

Royal Army Medical Corps

Graded Physician

AND

Brigadier R. A. BENNETT, M.D., F.R.C.P. Edin.

Consultant Physician F.E.L.F.

THE diagnosis of continued fever, especially in the Tropics, is beset with many difficulties. In many of these fevers, physical signs are few or absent, and the clinical picture may not fit in with any of the recognised causes of prolonged pyrexia. In a few, the localising signs of miliary tuberculosis, or some form of septicaemia sooner or later point to a correct diagnosis but, in quite a large number, the fever ends, the patient gets well, and the cause forever remains a mystery.

The conscientious and scientific doctor, for want of laboratory confirmation, is forced to classify these undiagnosed fevers as long-term P.U.O., a diagnosis which is unpopular both with the doctor himself, and the medical authorities, and is of little comfort to the patient, unless he be one of those people who like to boast that they have had a disease which has baffled all the experts.

In the military hospitals in South-East Asia, in 1946 and 1947, there were well over 100 cases of long-term P.U.O. diagnosed in British Troops alone.

The majority of prolonged fevers with indefinite signs and symptoms are usually considered to be enteric group infections, but in the absence of positive blood, stool or urine cultures, or a rising Widal, medical officers are reluctant to diagnose them as such.

We thought, therefore, that it would be of interest, and possibly instructive, to record a small epidemic of eleven cases of paratyphoid A fever which occurred in a British unit stationed in Singapore.

The cases were so mild, and often the symptoms so vague, that, had they been sporadic cases, the clinical picture would probably not have suggested an enteric group infection, and lacking laboratory confirmation they would have swelled the ranks of the pyrexias of uncertain origin.

It is not the intention to describe each case in detail, but rather to choose the salient features from eleven proved cases, giving a general view of the clinical features of this epidemic.

The first consideration of any long-term P.U.O. is presumably the type of temperature chart, this being itself often suggestive of a diagnosis. Although one cannot say that the chart in paratyphoid "A" fever is as diagnostically suggestive as that of malaria or dengue, yet even in this small series of cases

there were certain features in common which we felt, in retrospect, to be of assistance in diagnosis. The fever varied in duration from six to thirty-two days; in two cases the fever subsided during the first week of the illness; in two cases during the second week; in four cases the fever lasted into the fourth week, and the remaining three cases became afebrile early in the fifth week. After remission of the pyrexia occasional slight recrudescences from 99° to 100° F. lasting up to forty-eight hours were apparent in some cases for a further week or so.

The characteristic feature was the presence of a consistent "spiky" tendency throughout the pyrexial period, all charts showing this feature. Although there was some irregularity, the temperature tended to be normal or nearly so in the mornings rising to 102° to 104° F. in the late afternoons, subsiding again by the following morning. Towards the end of the illness the maximum daily temperature was gradually reduced until fever ceased. A typical chart is produced below. Although we were impressed with this "spiky" feature of the temperature charts in this epidemic, we do not wish to imply that it has a great diagnostic value.

One or two of the charts were misleading, as, for example, in one case where the fever was rarely above 100° F., but lasted twenty-five days, and the chart reproduced below to show the similarity to malaria. Inspection of the charts will show the slow pulse of this type of fever. In general, the pulse was below ninety per minute and commonly between sixty and seventy. In other ways, the pulse was normal, being regular, of good tone and volume, the dicrotic element prominent in typhoid fever being absent. There were no other cardiovascular signs at any stage of the illness, and the blood-pressure was well maintained.

The early symptomatology of the disease in these cases was extremely vague, furnishing no clue to the underlying nature of the infection. Headache was common in all cases. It varied in site from frontal to occipital, and in duration from two to five days. In no case did it last longer than five days, nor did it recur. At no time was it severe, nor did it interfere with the patients' activities before admission to hospital. It is of interest to note that three patients complained of pain behind the eyeballs, aggravated by movement of the eyes, but the generalized pains of dengue were not present at any stage.

The only striking symptom was anorexia. It appeared at the very onset often preceding all other symptoms, and was extremely persistent, not uncommonly lasting well beyond the febrile period, causing the patient some alarm, and being his main complaint. This one symptom was so marked that we felt it to be almost diagnostic in a patient, who, despite a fever of two or three weeks' duration, otherwise felt quite fit, and could not comprehend why he was being kept in bed.

In one case only was the complaint of an "enteric" nature, the patient having prolonged diarrhoea. The remainder of the patients either observed no change in their bowel habits, or had mild constipation. Despite the absence of any intestinal symptoms, in four of the patients, the stool culture was positive.

Apart from mild nausea and vomiting in the odd case, no other symptoms were present apart from those described above.

The most helpful sign to be elicited was the presence of a palpable spleen. This was present in five of the patients: it was easily palpable, firm, and with a minimum of tenderness, resembling more the spleen of recurrent malaria than that of enteric group fever.

Rose spots were absent, one patient only developing any form of rash—a vesicular rash on the flanks and abdomen appearing on the first day of illness and lasting for a few days only.

The white blood count was never raised, occasionally normal but commonly showing a relative lymphocytosis. The following are figures from two of the cases:

Total W.B.C. 5,000 per c.mm. Differential: Polynuclears 40 per cent, lymphocytes 55 per cent, eosinophils 2 per cent, mononuclears 2 per cent, basophils 1 per cent.

Total W.B.C. 6,100 per c.mm. Differential: Polynuclears 36 per cent, lymphocytes 63 per cent, eosinophils 1 per cent.

It may be of interest to indicate in tabular form the laboratory results in these cases. Some of the cases shown with negative stool and urine subsequently excreted the organisms during convalescence showing the importance of persistent investigation not only for academic purposes but for the safety of other members of the unit to which they will return.

In no case was the Widal test of any assistance in diagnosis.

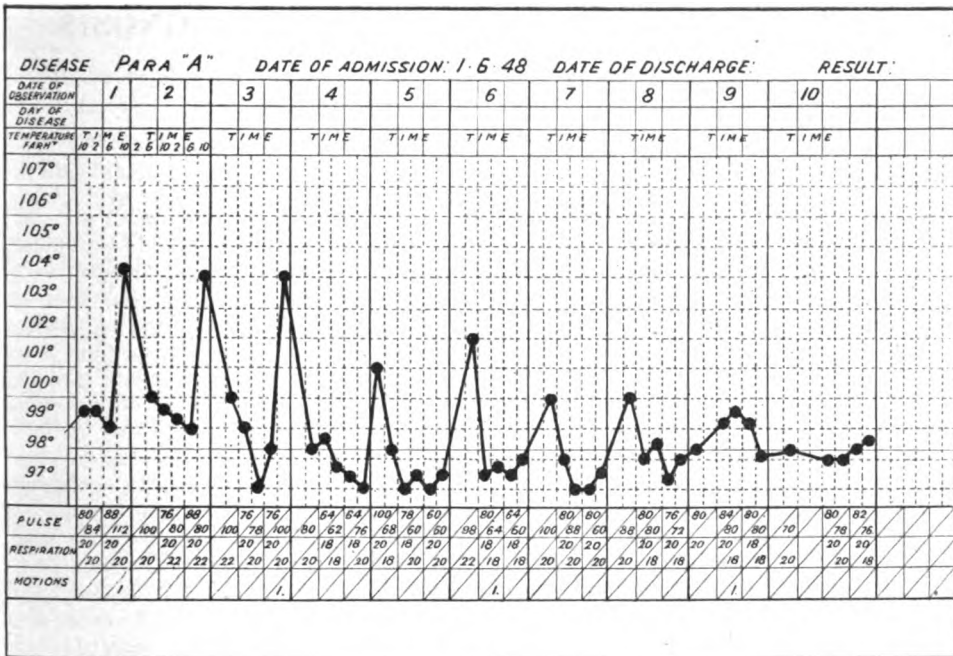
<i>Case</i>	<i>Blood culture Day of disease when positive</i>	<i>Stool Day of disease when positive</i>	<i>Urine Day of disease when positive</i>
1	+ ve 10th day	— ve	— ve
2	+ ve 3rd day	+ ve 4th day	— ve
3	— ve throughout	+ ve 14th day	— ve
4	+ ve 4th day	— ve	— ve
5	— ve throughout	— ve	+ ve 23rd day
6	— ve throughout	+ ve 15th day	— ve
7	+ ve 4th day	— ve	— ve
8	+ ve 3rd day	— ve	— ve
9	+ ve 5th day	— ve	— ve
10	— ve throughout	+ ve 12th day	— ve
11	+ ve 9th day	— ve	— ve

SUMMARY

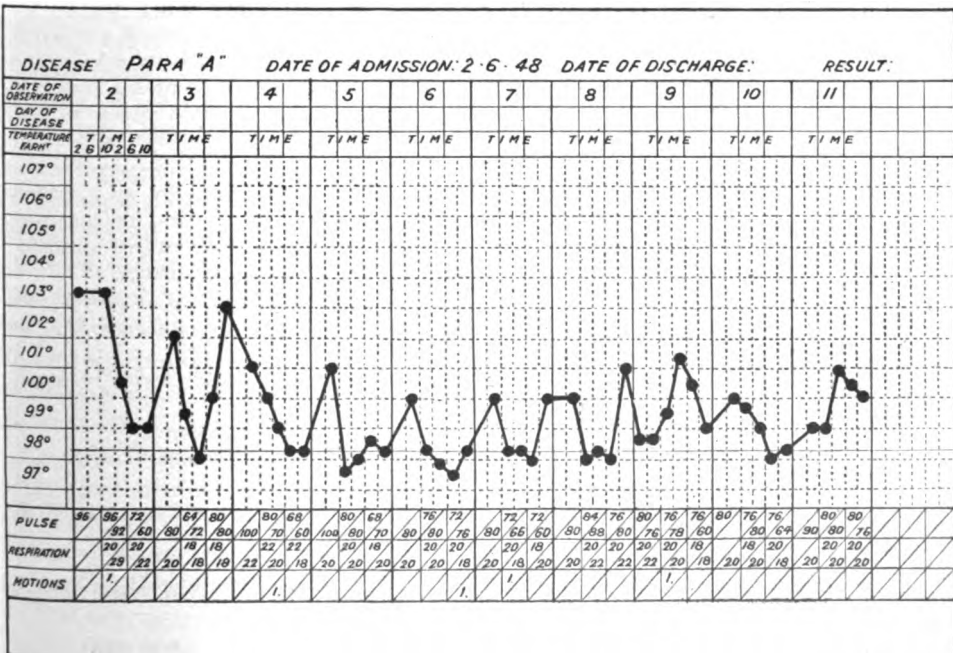
A small epidemic of paratyphoid "A" fever is described in which the main clinical features were a "spiky" temperature chart, with a slow pulse, a mild onset and a mild course marked by a persistent anorexia.

It is well known that fevers of the enteric group are sometimes very difficult to diagnose clinically, and we feel that the description of this small epidemic illustrates the importance of persevering with laboratory aids to diagnosis even in the mildest continued fevers.

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Similarity to Malaria.



A typical chart is produced above.

LABORATORY METHODS FOR THE DIAGNOSIS OF FEVERS

<i>Day of illness estimated from 1st day detained</i>	<i>Examination to be carried out</i>	<i>Remarks</i>
1st, 2nd, 3rd	Blood slide for malaria parasites	Two slides each time : one thick, one thin. If case is serious, slides should be examined at 2-hourly intervals on the first day
3rd, 4th, 7th	Blood culture	20 c.c. from a vein, distributed as follows : Into glucose broth or similar medium, 5 c.c. Into gentian violet taurocholate medium, 10 c.c. Into a test tube to obtain serum for Widal, 5 c.c.
3rd, 7th, 11th 15th, 19th, 23rd	Agglutination test : Enteric group Typhus group Brucella group	5 c.c. of blood in a test tube or 2 c.c. of serum in Wright's capsule. Agglutinations for Brucella group need only be done when undulant fever is considered to be a possibility
8th-12th 15th-19th 22nd-26th	Fæcal culture	1 c.c. of fluid fæces should be sent to lab. in 10 c.c. of buffered glycerine saline solution in a screw-capped bottle
8th-12th 15th-19th 22nd-26th	Urinary culture	Clean penis, prepuce and glans with spirit ; collect first morning urine preferably ; discard first flow, and collect in sterile test tube. For women, a catheter specimen is required. For samples sent by post, add 1 c.c. of 1/10,000 brilliant green to each 20 c.c. urine
1st, 5th	Chemical and microscopic examination of urine	NOTES : (1) To arrive speedily at a correct diagnosis, the value of following this scheme for routine laboratory examinations cannot be over-estimated (2) In the elucidation of obscure fevers, the following conditions should be kept in mind : (a) Malaria, dengue, sandfly fever, relapsing fever (b) The enteric group of fevers (c) The typhus group of fevers
3rd, 4th	Microscopic examination of fæces	(d) Undulant fever (<i>B. melitensis</i> and <i>B. abortus</i>) (e) Tuberculosis (f) Septicæmias (streptococcal, staphylococcal <i>B. coli</i>)
3rd, 6th, 12th, 19th	Leucocyte count	(g) Pyelitis, liver abscess, empyema (h) Kala-azar (i) Lymphadenoma and certain new growths

Correspondence

SIR,

In the interesting paper on "Evacuation of Wounded During Operations Involving the Use of Armoured Personnel Carriers" in your July number the comparison of these operations with those of Armoured Formations is misleading, since Armoured Regiments fight in their tanks, whilst Infantry in A.P.C.s are carried forward through prepared gaps in minefields and similar defensive areas or on a broader front across country, and then dismount and fight on foot. What then happens to the A.P.C.s is important to the medical services and it is probably different in a purely Infantry operation from one involving the "lorried" Infantry Battalion in an Armoured Formation.

In the latter there will be a 100 per cent lift for the Infantry, and the A.P.C.s may return to a Rear Rally or to a Forward Rally, there to await the result of the battle, a successful outcome of which might result in the A.P.C.s being called forward for a further advance. In purely Infantry operations the A.P.C.s will probably return to a Rallying area in the neighbourhood of the original Forming-up Area for a further load of troops; and the operations are thus more akin to a River Crossing in L.V.s.T. (Buffaloes or Neptunes) and, as in such battles, our aim is the rapid establishment of medical posts on both sides of the obstacle, and in the early stages casualties must be brought back by the returning A.P.C.s.

In discussion of points (1) to (4) in the paper it might be said that (1) is essential—the R.A.P. must be in an A.P.C. and should move with Battalion H.Q.; but (3) cannot be agreed to since the centre line deteriorates so rapidly that Field Ambulance stretcher jeeps and ambulance cars cannot be used until the operation has succeeded and a new centre line, probably along a main road or track, has been opened up. Only tracked vehicles can be used, and although in the later stages Bren-gun carriers may be useful A.P.C.s were found to be essential, and I do not think that medical staffs in 21 Army Group would have submitted to the "G policy on a high level" mentioned in (2) forbidding their use for wounded.

A.P.C.s are, as mentioned in (4), not ideal for stretcher carriage, and if the wounded are to be given the protection of the armoured sides, and shelter from weather by the tarpaulin cover, parts of the stretcher handles have to be sawn off, which is obviously unsatisfactory since one cannot keep any stretchers exclusively for use in one link of the chain of evacuation. The armoured ambulance may help, but there will never be enough of these to obviate the use of A.P.C.s, and since there are few vehicles in use in the Army which we may not have to use for casualty evacuation it is to be hoped that the possibility of fitting in stretchers is always kept in mind by those responsible for designing new patterns. One example of failure to consider this point appears to be the Neptune, which although bigger than the Buffalo does not offer such good accommodation for stretchers.

R.M.O.s sometimes found that the A.P.C. drivers did not co-operate intelligently with them, and they wanted some of the A.P.C.s used in the initial assault to be detailed for medical use, but this is unlikely to be agreed to,

though it might well be essential for the Motor Battalion of an armoured brigade if the A.P.C.s were to return only to a Forward Rally.

It would be interesting to hear the views of anyone with experience of these operations as a R.M.O. or Field Ambulance Officer, and one point for discussion might be whether, as in River Crossings, we should ask for A.P.C.s to carry a Field Ambulance detachment forward of the obstacle belt. This might be necessary if it were expected that normal evacuation by a centre line suitable for wheeled vehicles would be long delayed, in which case two A.P.C.s might be detailed to return to the Forming-up Area for this purpose, and subsequently to be used for casualty evacuation.

The method of evacuation used in 15 (S) Division for a break through of a main defensive area consisting of minefields, wire, anti-tank obstacles, etc., will be described, and if those with different experience would contribute their comments this correspondence might be useful.

Before H hour a Field Ambulance Company, usually reinforced by R.M.O.s of the supporting special armoured Regiments such as A.P.C.s, Flails, A.V.s, R.E., Crocodiles, Fascine Tanks, were in the Forming-up Area just behind the points at which the obstacle belt was to be breached. This was usually the site of the C.C.P., and as many thin-skinned vehicles and ambulances as possible were left at a Car Relay Post on the centre line in rear of the C.C.P.; where also should be the R.A.P. vehicles and the ambulances normally attached to R.A.P.s, which, whilst the R.A.P.s are in A.P.C.s, may well be under the control of the Field Ambulance Company Commander who will send them forward when the situation allows normal evacuation to replace the use of A.P.C.s and carriers.

As soon as possible before or after H Hour—the exact time can best be determined by the Brigade staff—a further medical post must be established near Gap Control H.Q., which is the point from which the Gap Control Officer controls the movement of traffic through the gaps and lanes in the minefields. This is an important medical post because the Battalion R.M.O.s in A.P.C.s will not open R.A.P.s until they are forward of the obstacle belt, and this post can deal with casualties in the Forming-up Area and around the gaps, which are liable to heavy gun and mortar fire. It was variously described as the Gap R.A.P., Gap C.C.P., and Gap Car Post, and as it is the point at which casualties are transhipped from A.P.C. to stretcher jeep, weasel, or two-stretcher ambulance, the best term is probably Gap Car Post. All medical posts and the A.P.C.s carrying the R.A.P.s must be clearly marked with the Red Cross, since, especially in the early stages before the centre line is well defined, the evacuation route is not easy for casualties to follow. The co-operation of the Gap Control Officer in directing A.P.C.s to the medical posts is invaluable.

Sites for medical posts must be chosen early and routes reconnoitred, and the C.C.P. at least must open before the assaulting force moves forward, or it will not be ready for the earliest casualties. Alternative sites for medical posts and alternative routes of evacuation should be reconnoitred and made known to all concerned before the operation. This is a wise precaution in any operation, but is essential in this type of battle, as the routes used by tracked

vehicles may soon become impassable for wheels. This risk also calls for a reserve section to be held well forward ready to open on the alternative route ; and it also makes the claim of the medical services to an allotment of weasels a strong one, as these vehicles are invaluable for evacuation of casualties from the Gap Car Post and for liaison between the Field Ambulance Company Commander and Brigade H.Q. and the R.A.P.s.

The layout in rear of the C.C.P. is normal. The regimental medical establishment of normal armoured regiments involved in the operation are employed in the usual way, whilst those of the special armoured regiments which are under command or in support to get the Infantry through the minefields may be used to supplement the resources of the assaulting division ; and, if provided as were the Regiments of the 79th Armoured Division with " subsections " of R.A.M.C. personnel, they are very useful for such tasks as Gap Car Post, or reserve C.C.P.s.

I am, Sir, Yours, etc.,

F. M. RICHARDSON, *Colonel.*

Obituary



Colonel CHARLES HENRY MILBURN

It is with great regret that we record the death of Colonel C. H. Milburn at the age of 88. He was the last surviving member of the deputation which,

representing the British Medical Association, met the Minister of War—Lord Landsdowne—in 1899 to discuss the future of the Medical Services of the Army.

Readers of the Journal will recollect the recent article, entitled “Our Will and Pleasure,” which appeared in our October number. Colonel Milburn died while this article was on the Press.

Colonel Milburn had a long and distinguished record of Military Service beginning with the 1st Newcastle and Durham Royal Engineers (Vols.) in 1878.

He later joined the 2nd East Riding Yorks Royal Garrison Artillery (Vols.) as a Lieutenant in 1886 and was made Hon. Colonel in 1906 and Lt.-Col. Commandant in 1907.

For over three years from 1908 he was Lt.-Col. Commanding the 2nd Northumbrian Brigade, Royal Field Artillery (Territorial), a Brigade which he raised himself.

In 1915 he was a surgeon on the staff of No. 2 British Red Cross Hospital at Rouen and also served in Ambulance Trains.

From 1920 to 1925 he was a Divisional Medical Officer with the Ministry of Health and later a Medical Referee under the Workmen's Compensation Act.

He was a man of great culture and had a wide range of interests—a keen antiquarian and, in his younger days, particularly interested in football, cricket and golf. His interests covered a wide range of social activities ranging from Boy Scouts to Social Service work.

In 1900 he was appointed an esquire of the Order of St. John of Jerusalem in England; in 1901 he was presented by King Edward VII with the medal for Conspicuous Service to the Order of St. John. In 1902 he was given the Special South African Medal.

In 1903 he was awarded the Volunteer Long Service Medal, in 1906 the Officers' Volunteer Decoration and in 1919 the *O.B.E.* (Military).

He had been a member of the B.M.A. for sixty-six years.

He always had a great interest in the Royal Army Medical Corps and it was a source of great pride that he had been a member of the deputation which secured Army rank for our officers. He was the only one of the deputation to see the Corps celebrate its Jubilee and took the keenest interest in the celebrations.

Reviews

OSTEOARTHRITIS OF THE HIP JOINT. By Dr. H. Warren Crowe. Publishers : The Dolls House Publishing Co., Ltd. Price 35s. 6d.

“Osteoarthritis of the Hip Joint” puts the case for infection as the cause of this disease. “Infection is the basal hypothesis propounded in this book and the reason for writing it” (page 20). Treatment is discussed at length. Intra-articular injection of acid sodium phosphate, diet, exercises and physiotherapy are advocated but chief reliance is placed on a carefully estimated course of a standard vaccine manufactured by the Charterhouse

Rheumatism Clinic. Detailed case-histories and X-rays of a series of joints before and after treatment appear at the end.

To those interested in the medical approach to osteoarthritis of the hip, this book will be of service. J. F.

EMERGENCY SURGERY. By Hamilton Bailey. To be issued in 5 parts.

Publishers : John Wright & Son Ltd. Part 2. Price 21s. per part.

This well-known and widely read book is being re-edited in 5 parts. Parts 1 and 2 have been received to date. Part 1 contains chapters on infusion, transfusion, anæsthesia drainage, acute appendicitis and its complication. Part 2 is devoted to the emergency surgery of the intestinal tract. The book is a mine of information for the surgeon who has to deal with all types of emergency. As such, it is of especial value to Service officers for the guidance is clear and concise and the illustrations, many of which are in excellent colour, admirably set off the text. Case-histories are frequently employed to bring out the difficulties of the urgent case. The author lays frequent emphasis on the hazards of single-handed work in small hospitals. Many of the difficulties described in these case-histories will recall to the reader similar personal experiences encountered during foreign tours of service in out-of-the-way places.

I especially commend this admirable book to all who, like ourselves, have to make surgical decisions, and act on them, in circumstances in which a second sound opinion, and skilled assistance, may be unobtainable.

D. C. McC. E.

Notice

HISTORIC MEDICAL DIARY

On display in the rare manuscripts room at the British Museum are the diaries and papers from Scott's last expedition. An interesting item is the 1910 "Wellcome" Medical Diary carried throughout his journey by Dr. E. A. Wilson, Medical Officer to the party. As legible as if it had been written to-day, it forms a record of personal and scientific observation second in importance only to Captain Scott's own papers. The diary was found in the tent where the South Polar explorers met their end.

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Original Communications.

PENETRATING WOUNDS OF THE KNEE

BY

NEIL G. C. HENDRY, M.B., F.R.C.S.Ed.

*Assistant Orthopædic Surgeon, N.E. Region of Scotland
(Late Orthopædic Specialist, R.A.M.C.).*

THIS paper presents an account of the treatment and end-results of 83 consecutive personal cases of penetrating gunshot-wounds of the knee which arrived at an orthopædic base hospital in India between February 1944 and August 1945. The main object of the paper is to draw attention to the seriousness of any fracture associated with such wounds, whether infected or uninfected, and to clinical and radiological signs referable to this, which, it is believed, have not previously been described.

All cases were battle casualties from the Burma theatre, where circumstances, for troops and medical staff alike, were so much more arduous than in other theatres that some brief mention of them must first be made. A full description of the conditions under which forward surgery was done, and of the line of evacuation to advance base, has been given by Johnson and Dick (1946), but the difficulty of the terrain deserves emphasis because of its marked influence on the condition of the wounded. Its effect dated often from long before wounding, for the hazardous nature of the lines of communication demanded that foodstuffs be supplied in a highly concentrated state, providing a diet which, although adequate in calorie value, none the less became so unappetizing after a few weeks unrelieved use that much of it might be refused, even in the presence of considerable hunger. To this subnormal nutritional state in the average patient was added the difficulties of forward surgery inherent in the remoteness and wide dispersal of many formations, so that the average time-lag between wounding and first operation over the whole series was of the order of thirty hours; finally, the wounded man had to face a journey from one crowded hospital to another back to advance base, and thence across India; the total distance being that from London to the Balkans, and the usual interval between wounding and arrival at the Indian base hospital being four

to six weeks. The only exceptions to this rule were the casualties from the Arakan beach landings early in 1945, who travelled direct to Madras by hospital ship and reached us, after a train journey of only twenty-four hours, eight to twelve days after wounding; their relatively excellent general condition on arrival demonstrated the toll taken by the long line of evacuation which the bulk of the casualties had to follow.

Two factors prevent this series from representing accurately all penetrating wounds of the knee received in Burma: (1) The percentage dying during evacuation is not known, and must have been considerably higher than in other theatres; (2) from about the end of 1944 onwards, most cases whose total disability period was likely to be three months or less were treated to conclusion in S.E.A.C., and the latter part of the series therefore contains an unduly high proportion of seriously wounded cases. Instructions regarding evacuation from India to the U.K. varied from time to time, but until comparatively late in the final campaign all men likely to be able to return to duty in any category were retained, and treatment in the base hospital in India continued therefore until either (1) the knee had reached a stage where no further hospitalization was required, and the patient was returned to his unit or passed to a toughening depot in a suitable category, or (2) it was obvious that the final disability would prevent further service, and the local and general condition permitted evacuation to the U.K. Towards the end of the series, the criterion for such disposal was altered to an estimated total disability time of three months or more, but as this coincided with the evacuation from S.E.A.C. only of the most seriously wounded, the final prognosis of these cases also could be accurately assessed by the time they were fit to travel home. All cases were, therefore, observed for a sufficient period for their eventual function to be known. The average duration of treatment from the time of wounding was, in cases returned to duty, four months, twenty-one days (maximum eleven months, twenty-one days; minimum one month, two days): and in cases evacuated home, also four months, twenty-one days (maximum nine months; minimum two months, eight days).

TREATMENT IN THE FORWARD AREA

In 5 cases, no information was available as to the primary treatment employed. In the remaining 77, wound toilet, without closure of either skin or synovia, was done in 42, with an average time lag before operation of thirty-one hours (minimum two hours, maximum nine days), and a sepsis rate of 54.8 per cent (23 cases). Wound toilet with closure either of skin or synovia, was done 14 times, including three with excision of the patella, after a time lag that averaged twenty-seven hours (minimum two hours, maximum, without penicillin, thirty hours; with penicillin, seven days), and a sepsis rate of 28.6 per cent (4 cases). Aspiration alone was the treatment in 7, average time lag fifty-one hours, and incidence of sepsis 42.8 per cent (3 cases). Fifteen cases, mostly through and through wounds with no bony and minimal soft tissue involvement, were not operated on at all, and had a sepsis rate of 20 per cent (3 cases). All cases had a course of a sulphonamide by mouth, starting usually a few hours after wounding. The sepsis rate, irrespective of the primary treatment

employed, in cases where bony damage was absent or limited to the entry of a foreign body which lodged in a condyle without producing fissuring or comminution, was 28·6 per cent (12 cases out of 42): and in cases with a fracture, was 65 per cent (26 cases out of 40). That this difference is not wholly to be accounted for by the mere exposure of bone to infection is shown by the sepsis rate of 29 per cent in all cases of wounds involving the mid-shaft of the tibia admitted to the same hospital over the same period; nor can the presence of a retained foreign body in those cases with fracture provide a satisfactory explanation, as, of 11 cases with a foreign body retained in bone without associated fissuring or comminution, only one became septic. These points are further discussed in the latter part of the paper.

After the primary wound toilet, such cases as demanded complete immobilization were evacuated to the rear in one or other form of Tobruk plaster: hip spicas were occasionally used prior to about September 1944, but they raised insuperable nursing difficulties on the long journey back to India, and their abandonment was followed by a considerable improvement in the average condition of patients on arrival. Cases with neither infection nor gross bony damage, or where infection was present but causing no systemic upset, travelled comfortably in plasters from groin to ankle. Some had already started knee movements by the time they were admitted.

TREATMENT AFTER ADMISSION TO THE BASE HOSPITAL

Three main groups of cases presented themselves:

(1) Those in whom wound healing had already occurred, sepsis having disappeared or been absent throughout: mobilization of the joint might or might not have been started. Those required only the normal rehabilitation of any traumatized joint, the degree of activity prescribed being controlled by any signs of irritability in the joint—increasing effusion, increasing pain, heat, loss of movement.

(2) Those in whom infection was still present, as evidenced either by a discharging wound or by a hot swollen joint containing turbid fluid, but in whom a systemic upset was minimal or absent. Open drainage in these cases was not indicated, and they resolved with aspiration and immobilization continued until the infection had subsided, i.e. until a trial mobilization produced no flare-up, when they fell naturally into group (1) above. Immobilization was by ankle-to-groin plasters, and neither traction nor the more complete immobilization of a plaster spica was found necessary. Secondary suture was done as indicated, with penicillin when it became available. This group without systemic upset was found to consist only of those without an associated fracture, and it is apposite, therefore, to illustrate here the remarkable powers of resistance to infection possessed by the intact knee:

Case 1 (Number in series, 55).—C. B., an R.A. sergeant, aged 24, was wounded by an H.E. shell in the right knee on November 30, 1944, while in an isolated post: it was seven days before he could be operated on, and the only treatment during that time was the application of repeated dressings, and four-hourly sulphonamide by mouth, starting thirty-six hours after wounding. From the second day onwards there were malaise,

fever, and considerable discharge of pus from the wound, and on the seventh day a "ragged dirty wound, $4\frac{1}{2}$ in. by 1 in., communicating with the suprapatellar pouch" was excised and sutured, two tubes for penicillin instillation being introduced into the joint and four into the superficial part of the wound. A total of 30,000 units of penicillin was instilled between the seventh and twelfth days, and by the twentieth day the wound had healed soundly and active movements were started. He came under my care six weeks after wounding, when movements were full except for 10 degrees limitation of flexion: there was no effusion, and no evidence of infection. He was given graduated exercises, and within a month had a full range of painless movement and was symptom-free doing fairly strenuous P.T. Five months after wounding, without any known injury or special strain, he had a recrudescence of low-grade infection in the joint which settled with aspiration and rest; a month later, he had a second more acute flare-up, which resolved after two intra-articular injections and a ten-day parenteral course of penicillin. Thereafter, recovery was uninterrupted, and he returned to duty in Category B2. He was last examined nine months after wounding, when he was symptom-free, doing duty which involved walking several miles daily: movements of the knee were full and without crepitus, and painless except when the last few degrees of flexion were forced. There was occasionally a small effusion after particularly strenuous exercise.

The control of infection in this knee was, of course, attributable to the penicillin, but it is noteworthy that so complete a recovery of function should have taken place in a joint which had, for at least some days after the wound, been the site of quite a heavy infection, and had suffered two subsequent low-grade recurrences.

(3) The third treatment group consisted of those in whom infection was still present, uncontrolled locally, and causing a greater or lesser systemic upset. It was in these cases that the effect of jungle conditions and of the long line of evacuation became most manifest, and they exhibited, almost without exception, a syndrome which was probably present to some extent in all the Burma wounded who suffered chronic sepsis, and which presented itself as a constant and unmistakable clinical picture accompanied by characteristic blood changes. These men were apathetic, yet with a pale anxious facies, often with a malar flush: the eyes were sunken, the tongue and the corners of the mouth fissured, and the skin dry and scaly, especially over areas subjected to pressure. Anorexia was marked and persistent, and the more severe cases showed also a distressing form of diarrhoea, five or six loose, bulky, and offensive stools being passed in the twenty-four hours, repeated microscopic examinations showing no evidence of dysentery. Sensibility to pain was greatly diminished, often to the extent that pus under tension in calf or thigh caused no complaint either of pain or tenderness in spite of careful questioning: knee-joints subsequently found to be the site of an advancing and destructive arthritis were frequently described as comfortable, and the temptation was great to consider that one was leaving well alone as far as the wound was concerned, and to attribute the pyrexia to some systemic illness.

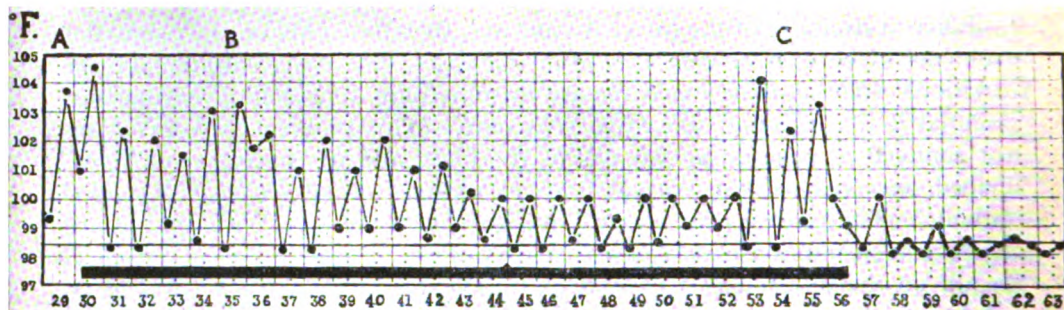
With so many factors interfering with protein metabolism—low intake, possibly for many months before wounding, followed by an anorexia that might be virtually complete, the losses from long-continued wound discharges and from chronic diarrhoea—it is not surprising that wasting was progressive and the plasma protein low. Total proteins of 5 to 6 grammes per 100 c.c. of plasma were common, even when some degree of dehydration was present, and in the

one fatal case in the series death was due to pulmonary œdema, persisting even after the administration of four-times-concentrated plasma, with a plasma protein that fell below 4 grammes per cent. The blood in the great majority of cases showed a hyperchromic macrocytic anæmia, and the white cell count, in spite of the sepsis present, was often only 5,000 to 6,000 per c.mm., and was rarely above 12,000. The significance of these changes was first brought to our notice by Lieut.-Colonel John Manifold, R.A.M.C., who was at that time in charge of the Deccan District Laboratory, and it was largely due to his interest that adequate treatment of the condition was evolved.

Efficient drainage of the infected joint was, therefore, only one of two major problems to be overcome in this group of cases, and the restoration of the nutritional state and the blood picture to something approaching normal was essential if the infection was to be overcome. (This problem, of course, was not confined to penetrating wounds of the knee, and the measures to be described were part of the normal hospital routine for all seriously wounded patients.) The general plan was to limit surgery to the barest minimum until the patient's condition had been sufficiently improved to permit a more radical assault on the infection. If gross dehydration was present, plasma was given by slow drip as soon as possible after arrival in hospital, and a fluid intake by mouth of the order of 10 to 12 pints in the twenty-four hours instituted: surgical intervention was limited to the release of pus under tension and the provision of adequate immobilization. Blood transfusion, and the infusion of plasma and occasionally of hydrolysed protein, were then used to prepare the patient for the next stage, together with parenteral penicillin when it became available, and this phase lasted usually about a week. At the end of that time, although the patient was still pyrexial, the toxæmia had diminished and the red cell count, which might have been as low as 1,500,000 on admission, was at least approaching more normal levels. The widest possible drainage of joint and of infected bone was then instituted, and the leg immobilized, by methods described below. Intravenous therapy, however, produced only a short-term improvement in the general condition, and the mainstay of treatment was the provision of a high-protein diet; liver, chicken, cheese, eggs, and milk being the main items. It was no easy task for the nursing staff to induce these patients to eat such a diet, but explanation reinforced by incessant cajoling usually overcame the difficulties, and it was remarkable how quickly anorexia and diarrhœa then disappeared, although it was some time, even if the infection had in the meantime been controlled, before there was any obvious improvement in the nutritional state.

No method of draining the infected knee has gained universal acceptance, and the multiplicity of techniques employed is, as ever, an indication of their several deficiencies. Possibly the commonest—two parapatellar incisions from joint level to the upper border of the suprapatellar pouch—was not found to be efficient, and although an improvement could be obtained if the patient were nursed prone, the added benefit was not worth the imposition on men who were already gravely ill. Similar incisions, the knee being held flexed about 45 degrees in a Thomas' splint, were more effective: other methods—

excision of the patella followed by nursing prone, and excision of the posterior part of the medial femoral condyle—were not tried. A modification of the two parapatellar incisions was used with dramatic results in the last seriously infected case in the series, and is now put forward as worthy of trial in any case where the infection is sufficiently heavy for eventual ankylosis to be likely. The method, and the circumstances of its first use, are described in the case notes below, and the effect on the patient's pyrexia, which previous attempts at drainage had failed to control, is shown in Graph I.



GRAPH I.—Temperature chart of Case 2, to show the effect of the method of drainage eventually employed. A—Incision through original wound, and removal of loose bone fragments. B—Two parapatellar incisions, extensive removal of necrotic bone from medial femoral condyle. C—Division of internal collateral ligament and immobilization of joint with about 30 degrees of valgus.

— = 20,000 units of penicillin 3-hourly.

Case 2 (Number in series, 75).—J. McI., an infantry corporal aged 34, was wounded in the knee by light machine-gun fire on May 7, 1945, the bullet traversing the joint from before backwards, producing a fissure fracture of the medial femoral condyle without displacement. Four and a half hours later the wounds were excised and partially closed, and the leg immobilized in a Tobruk plaster. He became pyrexial, and from the second to fifteenth day received 1,000,000 units of penicillin parenterally at the forward base hospital, but without significant effect on his temperature. He was evacuated to India, reaching us twenty-five days after wounding. He was then fairly seriously ill (pyrexial, and beginning to show those signs of toxæmia which have already been described. His left leg was in a Tobruk plaster, with much malodorous discharge around the knee. On his twenty-ninth day, dehydration having meantime been corrected and a high-protein diet instituted, the plaster was removed under general anaesthesia. The knee-joint was obviously infected, and the only drainage was through that small part of the exit wound, situated postero-medially, which had not been sutured. This wound was opened up throughout its entire length, a few loose fragments of infected medial femoral condyle were removed, and the leg immobilized in plaster. Parenteral penicillin, 20,000 units three-hourly, along with sulphathiazole by mouth, was started on the following morning. In the next few days there was little improvement in his general condition, and it was obvious that more radical measures were necessary: accordingly, on the thirty-fifth day, 2 pints of blood having been given forty-eight hours previously and a slow drip of plasma being maintained throughout operation, the joint was widely drained by Lieut.-Colonel J. S. Maxwell, R.A.M.C., two incisions being made along the length of the suprapatellar pouch, and much necrotic bone being removed from the medial femoral condyle. The leg was immobilized in a hip spica with the knee flexed about 30 degrees, and the patient was nursed for the greater part of the day and night on his face: the

same dose of penicillin was continued. Following this, he showed slight improvement, the temperature swinging only to about 100° instead of to 103° or 104° as formerly, but the infection was obviously not controlled, and his general condition again deteriorated and began to give rise to anxiety. Seven weeks after wounding, i.e. a fortnight after the operation just described, he was almost as ill as he had been on admission, and on the fifty-third day his temperature rose again to 104° , and his knee, which had up to then been painless, was stated to feel tight and swollen. The blood showed no malarial parasites, and there was little doubt that an acute exacerbation of the infection had occurred. It was decided that one more attempt should be made to control the infection by drainage, and that if this failed the leg would have to be amputated. On the following day, therefore (fifty-four days after wounding), with a slow drip of blood followed by plasma, the plaster was removed under general anæsthesia, and the continued presence of an acute infection of the knee-joint confirmed. The previous incision on the medial side of the patella was continued posteriorly along the joint line, dividing the internal collateral ligament: the tibia was then abducted about 30 degrees on the femur, and the view which was then obtained of the recesses of the joint gave cause to hope that none would be left undrained. A plaster hip spica was applied, maintaining the valgus position, and the patient was returned to his bed, to be nursed on his back: a second course of sulphathiazole was started that evening. Penicillin, which had been given three-hourly since the first operation for drainage, was continued for another two days to minimize the danger of a fresh spread of infection, and was then stopped, a total of 4,000,000 units having been given. There was an immediate improvement in the patient's general condition, and the temperature, after a rise to 103.6° on the first post-operative day, subsided to normal on the fourth day, and there remained, with only an occasional rise to 99° in the next week or two, until his evacuation to the U.K. eight weeks later. Twenty-three days after the final operation (seventy-six days after wounding) the valgus position was corrected under general anæsthesia without difficulty, and without causing any rise in temperature: thereafter, a plaster from groin to ankle provided adequate immobilization, and when this was last changed just before he was evacuated, the wounds were closed by healthy granulations, epithelialization of which was proceeding, and there was commencing fibrous ankylosis of the joint. His general condition was excellent. Graph I shows his temperature from the time of his admission until the final control of the infection.

All but one of these cases with toxæmia had an associated fracture, and drainage of this was also, of course, necessary. It was early found that soft-tissue drainage alone—i.e. down to and including periosteum—was insufficient, and that anything short of the widest drainage of the medullary cavity carried with it a high risk of subsequent flare-up. The effect of penicillin is discussed below.

RETAINED FOREIGN BODIES.

Twenty-nine cases in the series had foreign bodies retained in the joint or in the neighbouring bone, and removal had been undertaken in 9 prior to admission, usually at the time of the primary wound toilet. 7 cases had foreign bodies removed after admission, the indications being the same as those given by Buxton (1944) in his collected series of 273 cases from the Middle East—persistent sinus (2 cases), foreign body projecting from a weight-bearing portion of the articular cartilage (4 cases), or loose in the joint (1 case).

THE PART PLAYED BY PENICILLIN

Penicillin became available in September 1944, and was used on all infected cases, 14 in number, arriving after then. Only 7 cases in the series received the drug at the time of their primary wound toilet: this is due partly to the fact that it was not in general supply to forward units until late in 1944, but mostly

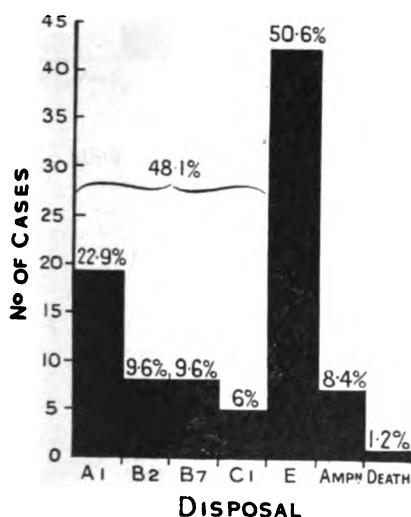
to the retention in S.E.A.C., once penicillin was available, of all cases with an estimated total disability period of less than three months. The cases that were seen in the latter part of the series, therefore, were largely those in whom penicillin had failed to prevent or to control infection, and do not give a true picture of its effect. The smallness of the numbers involved also prevents any definite conclusions being drawn, but it may broadly be stated that, in cases with an established infection, neither local nor parenteral penicillin had any appreciable effect in themselves apart from producing a slight subjective improvement in some; widespread excision of infected and devitalized tissue, and closure with or without a muscle flap under a penicillin "umbrella," which was commonly successful (occasionally dramatically so) in infected wounds of femur or tibia, was conspicuously unsuccessful where the knee-joint was involved. The contribution which penicillin made, therefore, was to provide a safeguard against a flare-up after drainage: that is to say, it extended, without otherwise altering, the scope of surgery. Attention has been drawn by Harley, Batey and Bowie (1946) to the occurrence of virulent strains of penicillin-resistant organisms in this theatre, and while this accounts for some of the difficulties, it does not, of course, explain the undoubted difference between wounds of the shafts of the long bones and those about the knee, both as regards the incidence of infection, as already mentioned, and its control. This point is also further considered below.

THE IMPORTANCE OF AN ASSOCIATED FRACTURE

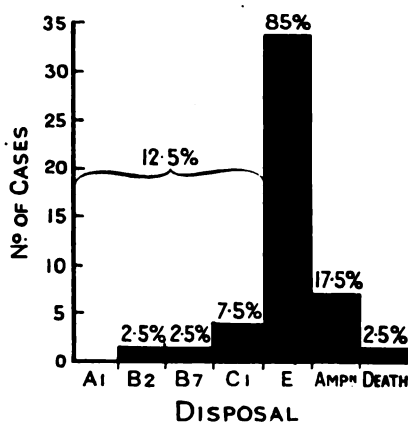
Interest in penetrating wounds of any joint has always centred on the prevention and treatment of infection, and it is probably true to say that, broadly speaking, a knee that remained uninfected has been regarded as having an excellent chance of recovery, provided always that there was no severe comminution of the joint surfaces: whereas little return of function was expected if joint sepsis supervened. Early in the present series it appeared that the presence or absence of a fracture into the joint had as important a bearing on the end-result as the presence or absence of infection. (This was in pre-penicillin days, and the control of Gram-positive organisms which penicillin now affords naturally makes the relative importance of a fracture even greater.) The point is best demonstrated by reference to the eventual disposal of the cases¹. Graph

¹End-results are all described in terms of the patient's Army Medical category on final discharge from hospital: this is thought to provide the most accurate convenient assessment of the eventual function of the wounded limb. All rehabilitation was carried out either in the hospital or in the neighbouring convalescent depot, so that the reaction of the knee to exercise was observed over a considerable period, and there was opportunity to correct any error in categorization that occurred. Category A1 cases were passed to a toughening course, any that broke down being returned to hospital, and it may be accepted that all who retained their grading were more than fit for the most strenuous civilian occupations: those in Categories B2 and B7 would probably, as civilians, be symptom-free in the great majority of occupations: those in Category C symptom-free only if their work was sedentary. Those discharged as unfit for further service, Category E, had disabilities which would be a considerable handicap in civil life—ankylosis, or a range of movement too small or too painful to be of value, or instability, or a tolerance to exercise so poor that even the minimum of weight-bearing brought on pain and swelling. Category E also includes, of course, all the amputations.

II refers to the entire series, and it will be seen that 40 of the 83 patients (48·1 per cent) returned to duty, 19 of them in category A1: 42 (50·6 per cent) were discharged the service, including 7 (8·4 per cent) with mid-thigh amputations: and there was one death (1·2 per cent). Of the 40 cases where there was an associated fracture, however, (Graph III), only 5 (12·5 per cent) returned to duty, none of them in Category A1, and 34 (85 per cent) were invalided from the Services: whereas the comparable figures for the 38 cases without fracture (Graph IV) are 31 (81·6 per cent) returned to duty, 19 of them (50 per cent) in Category A1, and 7 (18·4 per cent) invalided, with no amputations and no deaths. (Five cases with patellar fractures are excluded from this table, it being impossible to assess the relative responsibilities of the patellar and any other fracture in the total disability.) Reference has already been made to the powers of resistance of the intact knee to infection, and this is borne out by the end-results shown in Graph V—cases where there was joint sepsis uncomplicated



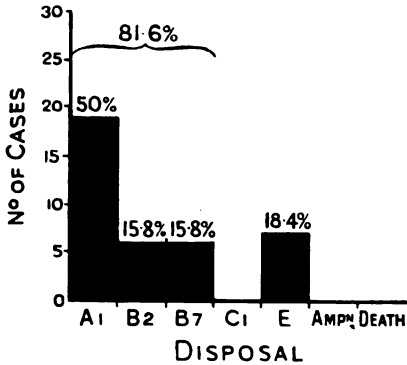
GRAPH II.—End-results for the entire series.



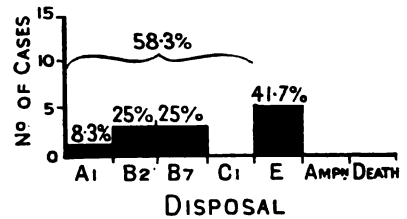
GRAPH III.—End-results, cases with an associated fracture into the joint.

by a fracture. The criteria of infection were either unequivocal clinical signs, or a positive culture from aspirated fluid: cases who showed an effusion on exertion with some polymorphs on microscopic examination are not included. It will be seen that of the 12 cases, 7 (58 per cent) returned to duty, the remainder being invalided, with no amputations and no deaths. Although the range of movement in a knee is not necessarily a true index of its usefulness, it is worthy of note that 7 of these cases had a painless range greater than 90 degrees, 2 had between 90 degrees and 45 degrees, and only 3 had less than 45 degrees. The number involved is small, but it is obvious that infection of a knee, by itself, does not preclude a good result in an appreciable proportion of cases. Very different is the case where infection of the knee is accompanied by a fracture into it (Graph VI). There were 26 such cases, none of whom returned

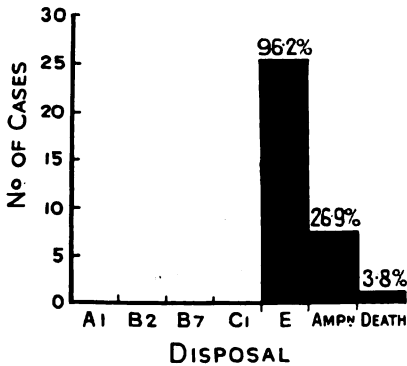
to duty, and one of whom died. All of them, without exception, had a severe toxæmia, and in 7 even the widest possible drainage, combined in the last two with adequate parenteral dosage of penicillin, did not avert amputation. There could be no more striking contrast than that provided by the patients in this group, cachectic and wasted, with the threat of amputation hanging over them, and those of the previous group, whose knees might drain pus, but whose faces



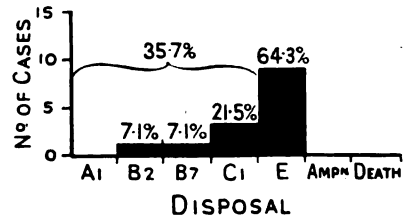
GRAPH IV.—End-results, cases without a fracture.



GRAPH V.—End-results, joint infected, but no fracture present.



GRAPH VI. — End - results, cases with joint sepsis and an associated fracture.



GRAPH VII. — End - results, cases with a fracture into the joint, but no sepsis.

showed the habitual good humour, and often the habitual good health of the British soldier.

Some difference was, of course, to be expected between cases where the joint alone was infected, and those with a bone infection in addition, and no particular interest was aroused, therefore, until it began to be noticed also that those with a fracture who remained aseptic were producing surprisingly poor end-results, as shown in Graph VII. Attention was accordingly directed towards those in whom the effect of the fracture could be seen uncomplicated by any

other factor, i.e. those in whom there was a linear fracture or merely furrowing of a condyle, with no displacement, no comminution of the joint surface, no retained foreign body, and a course that was, clinically at any rate, unequivocally aseptic throughout. There were 11 such in the series: no one seeing the minimal bone damage in their early radiographs would have expected anything but a rapid return to full function, yet none of them reached a high category, 6 of them were unfit for further service, and the average stay in hospital of the 5 who did return to duty was over five months. Their histories and clinical pictures had much in common: the wound had been caused by a high-velocity missile: non-weight-bearing exercise after a period of immobilization produced a good range of painless active movement, but some time after weight-bearing was begun, there was increasing pain on exercise, and often a reduction in the range of movement, and although these symptoms improved with rest, they returned as soon as weight-bearing was resumed, and the end-result was a knee, painless on mild exertion, but with a very poor, and often decreasing, tolerance to exercise. None of them showed any evidence, general or local, of joint infection, and any aspirated fluid was invariably sterile, and with no increase in cells. More detailed information about these 11 cases is given in Table I.

TABLE I.

<i>No. in Series</i>	<i>Wounded by</i>	<i>Duration of immobilization</i>	<i>Final range of movement</i>	<i>Category on discharge</i>	<i>Duration of treatment</i>	<i>Remarks</i>
4	Machine gun	88 days	80°	C	6 m.	Very poor exercise tolerance. Serial X-rays not taken
15	H.E. shell	18 days	90°	C	5½ m.	Very poor exercise tolerance. Serial X-rays not taken
18	Rifle	88 days	80°	E	5 m.	X-ray appearances of avascular necrosis at three months
30	Rifle	28 days	90°	E	4 m.	Serial X-rays not taken
33	Bren gun	35 days	145°	E	4½ m.	Still having effusions and pain after even slight exertion. Serial X-rays not taken
48	H.E. shell	34 days	120°	B2	6½ m.	X-ray and biopsy suggestive of avascular necrosis (figs. 2A, B and C, and 7A and B)
57	Bren gun	47 days	130°	C	4 m.	Sclerosis round bullet track after two months (figs. 1A, B, C and D). Exercise tolerance still decreasing at 11 months
67	Rifle	40 days	70°	E	4 m.	Sclerosis round point of entry of bullet into femur

TABLE I. (*continued*)

No. in Series	Wounded by	Duration of immobilization	Final range of movement	Category on discharge	Duration of treatment	Remarks
72	H.E. shell	56 days	150°	B7	3½ m.	X-ray at four weeks (fig. 3) resembles an osteochondritis dissecans, but affects a non-weight-bearing part of the condyles
73	Machine gun	26 days	80°	E	3 m.	Sclerosis of tibial condyle at three months
75	Rifle	44 days	130°	E	3½ m.	Sclerosis of tibial condyle at three months

TABLE I.—Analysis of all cases having a fissure or “furrow” fracture into the joint, but uncomplicated by displacement, comminution, sepsis, or a retained foreign body.

When the third of these cases (No. 18 in the series) was X-rayed some three months after wounding, the lateral femoral condyle, which had been the site of a fissure fracture, was found to show a widespread sclerosis with patchy areas of radiolucency scattered through it, and these changes were still present when, six months after wounding, he was discharged Category E with only 80 degrees of active and passive movement in the knee, unable to walk more than a quarter of a mile without pain, and having remained in a stationary condition for the preceding two months in spite of the most active physiotherapy. As it seemed probable that the X-ray changes were related to the unexpectedly bad result, it was decided to take serial radiographs at three to four weeks' intervals, on all other such cases that presented themselves. 6 such (Nos. 48, 57, 67, 72, 73 and 76) did in fact appear, and all of them showed identical radiological changes from about twelve weeks onwards. The description of these changes, and of the biopsy material that was obtained from one affected femoral condyle, is best given in relation to two representative cases:

Case 3 (Number in series, 57).—H. T., a private, aged 21, was accidentally wounded in the left knee by a Sten gun at a range of about 20 yards, the bullet passing through the medial tibial condyle, producing a fissure fracture into the joint without displacement and with no deformity of the joint surface (fig. 1A). Eighteen hours after wounding, wound toilet was carried out, the wound being left open and plaster applied. At five days, a tense and partly clotted hæmarthrosis was evacuated, microscopic examination showing no pus cells and no organisms, and culture being sterile. By means of a tube introduced through the small evacuating incision, 170,000 units of penicillin in a concentration of 1,500 units per c.c., were instilled into the joint between the fifth and tenth days, and he was thereafter evacuated to the rear, the plaster being changed once, on the thirty-first day, when the wounds were noted to be unhealed but clean, and the joint to be free from effusion. On arrival at the orthopædic base hospital, six weeks after wounding, he was afebrile and in good general condition, the leg was in plaster, and showed no motor, sensory, or circulatory upset. The plaster was removed four days after admission, when the wounds were found to be healed, the knee showing no effusion or heat, and X-ray commencing union of the fracture without deformity (fig. 1B). Off-weight exercises were

started. Three weeks later, X-ray showed an oval area of increased density surrounding the fracture line, and stereoscopic views a week later (ten weeks from wounding) showed this to be a mass of dense bone extending from front to back of the medial condyle, and varying in thickness from $\frac{1}{4}$ in. to $\frac{1}{2}$ in. (fig. 1c). Clinically, recovery proceeded



FIG. 1A

FIG. 1B

FIG. 1A.—Case 3, five days after wounding, showing fissure fracture of the medial tibial condyle, involving the knee-joint, but without significant deformity of the articular surface.

FIG. 1B.—Same case, six weeks after wounding, showing healing of the fracture with no alteration in bone density.

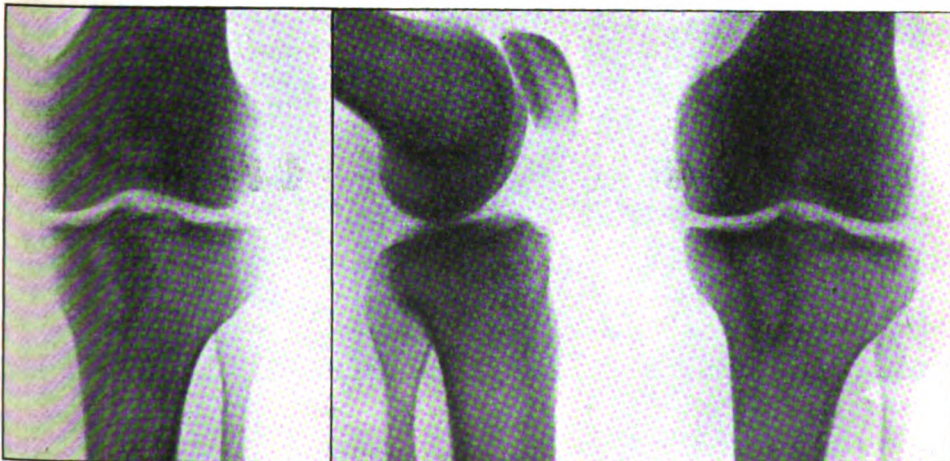


FIG. 1C

FIG. 1D

FIG. 1C.—Same case, ten weeks after wounding, showing mass of bone of increased density surrounding the original bullet track.

FIG. 1D.—Same case, ten months after wounding, showing persisting sclerosis round the bullet track, flattening of the medial tibial articular plateau, and sclerosis of its sub-chondral bone.

satisfactorily, and at about twelve weeks, when weight-bearing was started, he had 130 degrees of painless active movement. X-ray a week later showed no change. From this point onwards, the knee steadily deteriorated, and although the range of movement remained at 130 degrees, pain began to be experienced after exertion, and there was crepitus throughout the entire range. X-ray sixteen weeks after wounding showed the sclerosis to be still present in the tibial condyle, with, in addition, flattening of the medial half of the tibial plateau, and compression of its subchondral bone. Four and a half months after wounding he was discharged Category C, permanent, and employed in the hospital, his duties consisting mainly of the delivery of messages by cycle, so that he had the maximum of non-weight-bearing exercise. He was last seen on October 15, 1945, ten months after wounding; he stated that the distance which he could walk without pain had gradually decreased until it was now only a few hundred yards, his absolute maximum being about a mile: he had pain also on waking up, and on first moving the knee after a period of rest: there were occasional small effusions. On examination, quadriceps tone was good, extension was full, flexion was 130 degrees, with marked crepitus throughout, and there was no ligamentous laxity. X-ray (fig. 1b) showed that the ring of sclerosis persisted in the medial tibial condyle, with a central area of rarefaction, while the flattening and subchondral compression had become marked. There was very slight lipping of the lower pole of the patella, but otherwise no sign of osteo-arthritis.

Case 4 (Number in series, 48).—J. H., an infantry corporal, was wounded in the left knee by an H.E. shell on November 14, 1944, the missile producing some comminution of the non-articular part of the lateral femoral condyle and a fissure fracture without displacement, running into the intercondylar notch (fig. 2A). At four hours, the wounds were excised and left open, and the leg immobilized in plaster. He ran a low-grade pyrexia for the next few days, but had little pain and no malaise: at three days a large

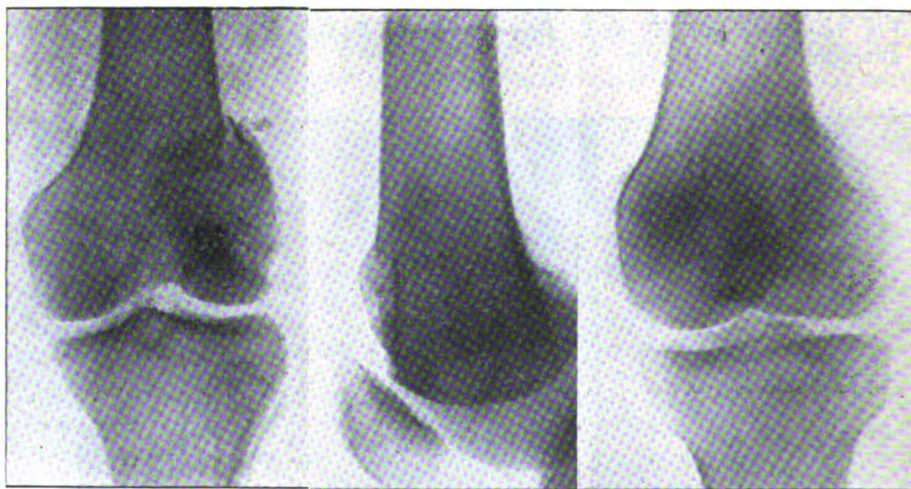


FIG. 2A

FIG. 2B

FIG. 2C

FIG. 2A.—Case 4, three days after wounding, showing fissure fracture of the lateral femoral condyle without significant displacement.

FIG. 2B.—Same case, fourteen weeks after wounding, showing three large and several small areas of radiolucency, surrounded by sclerosis, in the lateral femoral condyle.

FIG. 2C.—Same case, twenty-one weeks after wounding, showing patchy sclerosis and radiolucency, and flattening of the affected condyle. The wedge-shaped area of rarefaction is the biopsy site.

collection of blood was evacuated from the joint, and a prophylactic course of sulphathiazole started. Thereafter, he became apyrexial, and was evacuated to the rear base hospital, where he arrived twenty-four days after wounding in excellent general condition. A white cell count six days after wounding had shown 10,200 cells per c.mm., and a normal differential count. Examination on the twenty-eighth day showed a clean superficial granulating wound, about 1 in. square over the antero-lateral aspect of the knee, no effusion in the joint, and no heat. X-ray showed the fracture to be uniting without deformity: there was no alteration in bone density. The leg was immobilized in a Thomas' splint so that the wound could be dressed, and when this had healed on the thirty-sixth day, off-weight exercises were started. One month later, the wound having remained healed, and there being 75 degrees of painless active movement, minimal weight-bearing was allowed; the amount of this was gradually increased until at fifteen weeks he was doing fairly strenuous P.T. without pain, but the range of movement had remained stationary, the limitation being due to the scar on the antero-lateral aspect of the knee. X-ray a week previously had shown fairly widespread sclerosis in the lateral femoral condyle on both sides of the original fracture, with three large and numerous small areas of normal density within it (fig. 2B). As the nature of this was in doubt, and as excision of the scar had obviously to be done, it was thought justifiable to do at the same time a biopsy of the affected bone. Accordingly, on March 8, 1945, sixteen weeks after wounding, a wedge of bone was removed from the lateral femoral condyle, without encroaching on the joint. It was of varying consistency, the deepest part being dense, and the remainder soft: there was no naked-eye evidence of infection, and culture was sterile. (The microscopic appearances of the biopsy material are described below.) One month after operation, knee movements had increased to 110 degrees, and the patient

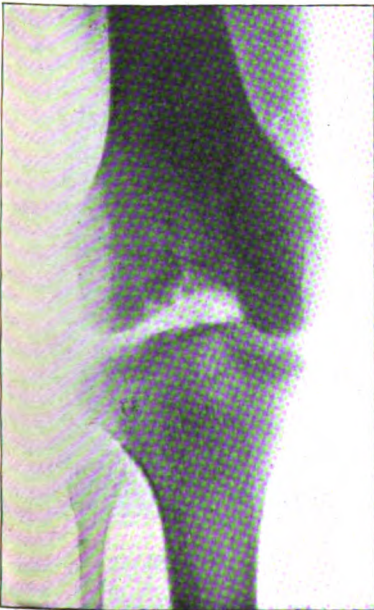


FIG. 3

FIG. 3.—Condition resembling an osteochondritis dissecans, seen four weeks after furrowing of the intercondylar notch of the femur by a fragment from an H.E. shell.



FIG. 4

FIG. 4.—Showing area of sclerosis in the lateral femoral condyle fourteen weeks after furrowing by a machine-gun bullet. (Excision of the patella at the time of primary wound toilet.)

was doing strenuous P.T. without symptoms; but from then on, although the range was unaltered, the capacity of the knee for exercise gradually decreased, and pain on exertion, similar to that described in the case above, made its appearance. Twenty-one weeks after wounding, X-ray showed flattening of the lateral femoral condyle, the sclerosis and patchy radiolucency being unchanged (fig. 2c) which also shows the biopsy site), and a last X-ray seven weeks later showed the same appearances. On his discharge from hospital twenty-eight weeks after wounding he could walk only about a mile without severe pain, and had occasional effusions; quadriceps tone was good, there was no ligamentous laxity, extension was full, and there was moderate crepitus throughout the entire range of 110 degrees of active and passive movement.

Other X-rays reproduced are those of patients who sustained only the minimum of "furrowing" of a femoral condyle. One, where the injury was at the anterior end of the inter-condylar notch (wound received with the knee in full flexion) shows, four weeks after wounding, what is virtually radiologically, an area of osteochondritis dissecans (fig. 3): the other, whose shattered patella

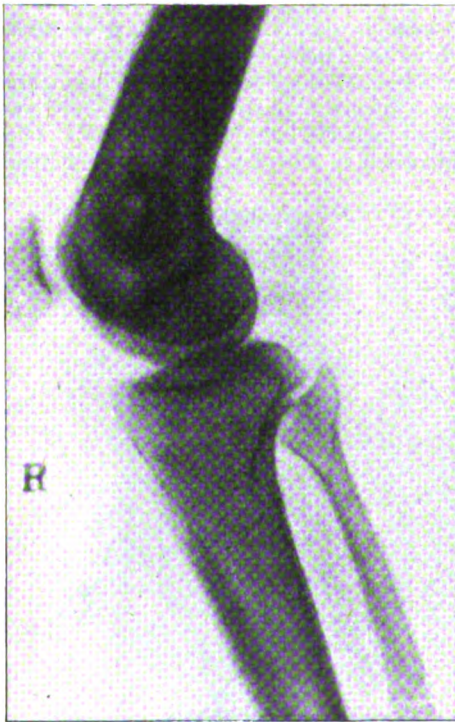


FIG. 5A

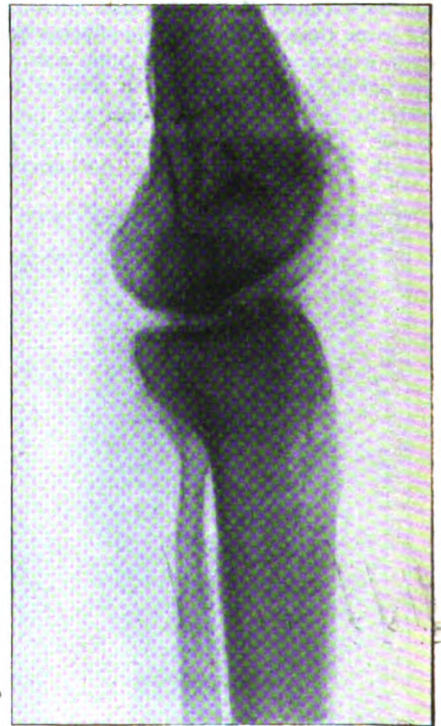


FIG. 5B

FIGS. 5A and 5B.—R. and L. knees of a patient wounded at short range from the right side by a single .303-rifle bullet. Massive sclerosis in the right femur: less marked sclerosis in left femur.

was excised at the primary wound toilet, shows a wedge-shaped area of sclerosis at the site of a coincident injury to the upper part of the femoral condyle (fig. 4). The films reproduced in figs. 5A and 5B were lent to me by Lieut.-Colonel

Lawler, formerly Adviser in Radiology to Southern Army, India, and are included here, although the case is not one of the series, because they produce confirmatory evidence in favour of the hypothesis which is to be propounded below. They show the right and left knees of a patient, both of whose femora were traversed by the same missile—a .303 bullet fired at short range during an exercise. Both show sclerosis round the drill holes in the condyle, and in stereoscopic views this can be seen to affect their entire width: the thickness of this ring is considerably greater in the right knee, from which side the patient was wounded, than in the left. Similar appearances have also been observed where missiles have traversed other masses of cancellous bone, notably in the os calcis. It is to be observed that in all these cases the missile was moving at least fast enough not to be retained.

Serial X-rays at three-weekly intervals were also taken of a case where a fragment from a mortar bomb had entered the condyles just above the superior pole of the patella, and had had sufficient velocity only to carry it to the posterior end of the inter-condylar notch, producing no fracture. At no time was there any alteration in bone density along the track except for one possible area at the site of entry (fig. 6, sixteen weeks after wounding), and this absence



FIG. 6.—Retained fragment from a mortar bomb, sixteen weeks after wounding. No sclerosis along the track, except for one small doubtful area at the site of entry in the anterior margin of the lateral femoral condyle.

of any pathological change was borne out also by the clinical appearance of the knee, which recovered a full range of painless movement, and had a normal tolerance to exercise. Neither was there any alteration in bone density in any other of the 11 cases with a retained foreign body and no fracture; and recovery of function was rapid and complete, their disposals being—Cat. A1, 8; Cat. B7.

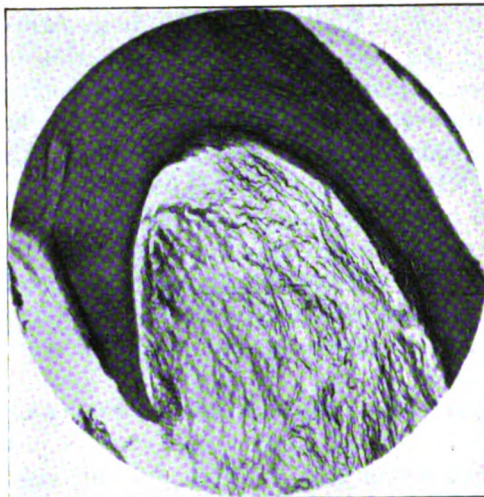


FIG. 7A.—Biopsy from Case 4, showing acellular bone in a matrix of fibrous tissue. (Magnification $\times 90$.)



FIG. 7B.—Biopsy from Case 4, showing some lacunæ filled with bone cells, the remainder empty. A collection of osteoblasts is present at the bone margin, top centre. (Magnification $\times 90$.)

2; and Cat. C1. Two points are clear: (1) the occurrence of sclerosis in femoral or tibial condyles was related absolutely to a progressive deterioration in the function of the affected knee, and (2) the radiological changes appeared only after fissuring or furrowing of the condyle by a missile which was not retained.

MICROSCOPIC APPEARANCE OF AFFECTED FEMORAL CONDYLE

The biopsy material obtained from Case 48 was found on section to consist of a matrix of vascular fibrous tissue, through which islets of cancellous bone were scattered. The greater part of this bone was acellular (fig. 7A) while such lacunæ as contained bone cells occurred in well-defined areas, usually in relation to the Haversian canals. Groups of osteoblasts were scattered throughout the section. There was no evidence of infection (figs. 7A and B).

DISCUSSION

When cases in this series whose knee wounds were complicated by fractures are compared with those without fracture, four facts emerge which require elucidation. Three of these—the high incidence of sepsis, the extreme toxicity of the infected cases, and the bad results of the uninfected cases—are not open to dispute: the occurrence of the fourth—the radiological changes in the clinically aseptic cases—is also beyond doubt, and it may at least be definitely stated that the fractures do not follow the normal radiological course of healing. The causation of the changes, however, is open to argument, and there are thought to be four possible explanations:

(1) That these changes are due to a subclinical infection. It must be admitted that the only clear radiological evidence against this hypothesis is the complete absence at all times of any signs of periostitis, but it might also be expected that a long-continued low-grade infection would produce a subchondral rarefaction, whereas the change seen in this area was always an increase in density. Bacteriological and microscopic examination of aspirated fluid was not done in every case affected, and sterile cultures and negative microscopy in those that were examined is not necessarily conclusive evidence of sterility, but it is unlikely that all these knees should have passed through all the stages of their rehabilitation, and even more unlikely that a biopsy could have been done on one, without a latent infection becoming at least temporarily obvious. Also, were sepsis the cause, it would be reasonable to expect a higher incidence of these changes where foreign bodies were retained, whereas they occurred exclusively where the wounding missile did not lodge—i.e. they are produced by missiles of the higher velocities, which again are generally accepted as being less infective than those of low velocity. Finally, the evidence of the biopsy is strongly in favour of the process being an aseptic one. It may, therefore, be said that while the radiological evidence is equivocal, there is considerable clinical and microscopic evidence against the infective hypothesis.

(2) That it is an aseptic reaction to multiple foreign bodies, too small to be visible radiologically. The discrepancy between this view and the relation of the changes to radio-opaque retained foreign bodies is obvious: it is also

unlikely from a physical point of view that such a wide dispersal should take place, and highly improbable that such fragments should be of such uniformly small dimensions that none was visible.

(3) That they are due to some action of synovial fluid on the fractured surfaces. This is mentioned only to be dismissed, as the absence of similar changes in closed fractures into a joint is unanswerable evidence against it.

(4) That they are due to some physical effect of the missile. This is suggested in the first place by their having been found only in those cases where the wounding missile had sufficient momentum not to be retained, and is supported by the following considerations: A high velocity missile traversing bone must of necessity lose a considerable amount of energy, which must be dissipated either as a concussion wave through the fluid elements of the bone, or as heat, or both. It is, therefore, reasonable to postulate that a considerable volume of bone surrounding the track of such a missile would suffer cellular death, either from disruption by the concussion, by thermal effects, or secondarily from a vascular thrombosis, or from a combination of all these, i.e. that the physiological damage in these cases is much greater than the immediately obvious radiological damage. Such a volume of acellular bone, if it remained aseptic, would presumably follow the familiar course of an avascular necrosis elsewhere—sclerosis, flattening, irreversible degeneration of any overlying articular cartilage, and then gradual, re-vascularization and replacement of bone cells, appearing as a patchy radiolucency. This hypothesis, therefore, provides the most acceptable explanation of the radiological changes in question: it explains their absence when the wounding missile is moving slowly and is retained, as in the knee shown in fig. 6, and is in keeping with the more widespread changes seen in fig. 5, in the knee which was traversed by the bullet first.

Moreover, if this hypothesis is applied to the other three unexplained effects of associated fractures mentioned above, a ready explanation of all of them is immediately available. The mass of devitalized bone surrounding the missile would form a nidus for infection inaccessible to the cleansing knife, and much less resistant even than the shattered cortex of a long bone, where the periosteal blood supply at least is still largely intact: the infection, once established, would be remote from the attacks both of the patient's own defensive mechanism and of chemotherapeutic agents in the blood, while in those cases in whom infection did not supervene, the flattening of the affected condyles and the degeneration of their articular cartilage would lead to a slowly progressive arthritis, with the crepitus and gradually decreasing exercise-tolerance which were the salient features of the cases summarized in Table I.

Further confirmation is provided by the microscopic appearances of the portion of femoral condyle removed from Case 48: these are certainly consistent with the healing stages of an avascular necrosis, and are at least definite evidence that bone had been destroyed some distance away from the fracture site, and that healing was still at an early stage sixteen weeks after wounding in an area which has normally an excellent blood supply and shows correspondingly rapid union.

CONCLUSIONS

There is considerable clinical, radiological, and, from one case, microscopic evidence, that the passage through the cancellous bone of femoral or tibial condyles of a missile moving sufficiently fast not to be retained produces cell death over a wide area, and that X-rays in the first few weeks after wounding show much less bone damage than has actually taken place. The dire effects of infection in penetrating gunshot wounds of the knee are probably due, not only to the "disposition that the cavities of joints have to fall into the suppurative inflammation" described by Hunter, but also to the presence on either side of the joint of two large masses of cancellous bone which can be extensively devitalized by a high velocity missile. Infection of such a wound requires the widest possible drainage, in an attempt, if anatomical circumstances and the condition of the patient allow, to excise all traumatized tissue and to leave no organisms unexposed to the natural and chemotherapeutic defences of the blood-stream. Better results are likely to be obtained in uninfected cases if weight-bearing is avoided until the density of the affected condyle has returned to normal, and the risk of deformity is past, but complete long-term recovery is unlikely. There are probably many men who were discharged from the forces after a gunshot wound of the knee with a relatively small disability, who are now faced with a major and increasing one, with no marked X-ray changes in the joint itself.

SUMMARY

(1) A series is presented of 83 consecutive cases of penetrating wounds of the knee sustained by British personnel in Burma and treated to conclusion in an orthopædic base hospital in India. 40 of the patients returned to duty, 19 in Category A1; 42 were invalided from the Service, including 7 with mid-thigh amputations; there was one death.

(2) The scope and type of forward treatment is summarized, and a more detailed account given of treatment at the base. It is suggested that the heavily infected knee is best drained by two parapatellar incisions, with division of the internal collateral ligament and immobilization of the joint in valgus.

(3) Attention is drawn to the grave effect of an associated fracture in both infected and uninfected cases. Clinical, radiological, and, in one case, microscopic evidence is adduced in support of the theory that high-velocity wounds involving the cancellous bone around the knee are followed by a condition analogous to avascular necrosis.

(4) Mention is made of the implication of these findings, should they be accepted, and in the treatment of penetrating wounds of the knee.

My grateful thanks are due to Brigadiers A. Grant Massie, *C.B.E.*, and John Bruce, *C.B.E.*, late *R.A.M.C.*, formerly Consultant Surgeons to *G.H.Q.* (I), and 14th Army respectively, for their interest and encouragement; to Lieut.-Colonel J. S. Maxwell, *R.A.M.C.*, for the opportunity of treating the cases and for much helpful advice on clinical problems, and in the compilation of the material for this paper; to Lieut.-Colonel Lawler, *R.A.M.C.*, for the radiographs reproduced in fig. 5, and for advice on radiological problems; to

Major J. Manifold, R.A.M.C., for the preparation of the biopsy material and advice on its microscopic appearances; to Sjt. A. Young, R.A.M.C., for the majority of the radiographs, and to Mr. W. H. Carnie, of the Department of Surgery in the University of Aberdeen for the two photomicrographs.

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“LOOKING AT HEALTH”

BY

Major D. H. D. BURBRIDGE
Royal Army Medical Corps

THE SHIFT OF EMPHASIS

DURING man's long struggle to conquer his environment and to outstrip the ills that beset him he has carried a banner with that strange device “Hygiene.”

In a civilized community and in the absence of war's devastation, sanitation is now taken for granted; although it is little time since our pioneers completed their drains and straightened their aching backs to see before them a rushing torrent of sickness which their efforts had left as yet unconquered.

They plunged into this maelstrom of conflicting chains of infection and began crudely to canalize and subdue it. Now, though flowing swiftly and liable to flood, it is reasonably controlled. Henceforth, carrying our ubiquitous banner, we can turn to the unexplored acres of health that lie beyond.

Thus at different times hygiene has become synonymous in the public mind with sanitation and preventive medicine or any facet of it that has been given publicity. The current juxtaposition of hygiene and health is not yet appreciated.

It may be presumptuous to profess the science of health when its definition still eludes us, but, as our banner is always to the front, so the definition of our subject is always of what we would like to cover rather than of what is within our present capacity. The Army definition unnecessarily complicates our task by fogging the issue; but we are all aware that our major preoccupation will in future be with this exploration of health.

There follows an attempt to forecast what we may ultimately be in a position to prove. Abstract thought on this subject can do no harm and has the merit of purging the mind of clichés and uncorroborated dogmas.

DEFINITIONS

In this paper it is hoped to use no term which is not first defined; and to build up definitions by a natural sequence of ideas. *The terms as defined are for the purpose of this paper only and may not be understood to mean the same outside this context.*

1st Group

Constitution

A constitution is to be regarded as an entity comprising an individual's inherited mental and physical make-up, together with any stigmata placed upon it by environment.

Total environment

Total environment is to be regarded as the social, economic, political, physical and psychological structure with which the individual is encompassed—the sun in the heavens and the food in his bowel, the lavatory seat and the wireless next door, the fear of God and the hole in his sock.

Stigmata

Stigmata are to be regarded as alterations, temporary or permanent, made to an individual's constitution by the passage of successive environments.

Well-ill-being

This is the state in which any individual finds himself when confronted with any given environment. (No word in our language is exactly apposite.)

We can now study the interrelation of these factors.

POSTULATES

A man's well-ill-being is the sum of his constitution and his total environment.

Argument

From the moment of conception an individual is destined to die.

The existence of life in an individual attaches a positive quality to his constitution, although that positive quality may be the sum of conflicting positive and negative elements within the constitution.

The existence of an individual is impossible to conceive without the coexistence of an environment, of which certain elements are essential to life, but which makes demands on, and applies stresses to, his constitution at the same time. That an individual dies may be an inherent constitutional function but this is impossible to prove: whereas it is easy to conceive it as a function of the interplay between the constitution and environment.

Hence, although there may be positive, life-sustaining qualities in environment, there is a preponderance of negative environmental demands and the sum of these gives total environment a negative quality. A state of constant conflict can thus be deemed to exist between constitution and environment, and the outcome of the conflict must be the sum of the opposing forces (each being prefixed by the opposite arithmetical signs).

Well-ill-being is peculiar to the individual and constantly changing in the individual.

Argument

Total environment is without extension in the Time dimension. What is apparently a continuous environment is, in fact, a series of infinitely close, static environments.

The first environment will leave its stigmata, temporary or permanent, on the inherited constitution and it is on the inherited constitution, modified by the stigmata imposed by the previous environment, that successive environments impinge.

In fact, both the constitution and the environment alter with each passing moment, the previous environments largely determining alterations in constitution, the constitution only minutely affecting the change in environment.

Each inherited constitution is peculiar to the individual; and since each individual is confronted with his own series of peculiar environments, the stigmata inflicted on that constitution are also peculiar to the individual.

Therefore, well-being must be peculiar to an individual and, at any moment, peculiar to that moment.

FURTHER DEFINITIONS

We can now proceed to define the possible results of the conflicts between the individual and his environment.

Health

When at any moment of time an individual is "on top" of his environment he is in a state of *Health*,

i.e., if C (Constitution) has a + value; E (Environment) has a - value.

$$C + E = + = \text{Health}$$

Sickness

When at any one moment of time an individual's environment, or any part of it, is on top of him, he is in a state of *Sickness*,

i.e., $C + E = - = \text{Sickness}$.

Neutrality is not likely to occur and if it does, can only be momentary.

We can now study the inter-relation of these factors.

POSTULATES

Health and Sickness, as defined, are incompatible, and are each basically the absence of the other.

This is self-explanatory.

When a man is sick it is not possible to admit that he has "health." Conversely a man in health cannot have sickness in any part of him.

Argument

This must be so. Yet here we encounter loose thinking, largely because terms are loosely defined. When we say "he is very healthy but has a severe coryza" we mean that his average constitution is normally on top of his average total environment. In fact, at the moment of consideration his immediate previous environment has conquered him and the stigmata imposed by it have rendered him as yet unable to "top" his present environment: by definition he is not in health but in sickness.

N.B.—Pain is a stigma incompatible with health. Because pain is a symptom of sickness and sickness is the antonym of health, this observation can hardly be regarded as profound: nevertheless the point has been overlooked.

There are many gradations of sickness and of health beyond the mere absence in each of the other.

Argument

The opposition of a series of different constitutions to an identical environment must lead to different outcomes.

The opposition of a series of different environments to an identical constitution must lead to different outcomes.

These oppositions, combined, constantly occur (*vide well-ill-being above*).

Therefore, the different outcomes occur, and must be represented as gradations of health or sickness, according to the sign of the arithmetical sum.

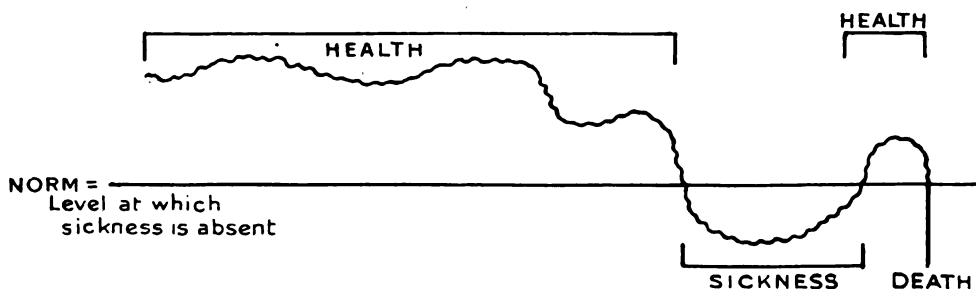
The degree of health or sickness cannot have any extension in the Time dimension except as a curved line which itself has curved trends.

Argument

The degree depends on the outcome of momentary conflicts, each of which is between two variable factors.

The outcome must vary from moment to moment and the plot of the outcomes must be curved.

Apart from the constant minor changes in environment and constitution, there are major trends due particularly to major changes in environment, followed in successive conflicts by major stigmata. Thus a plot of the degree of health and sickness will look like this:



*It is not safe to assume that a man who is in health to his present environment will be in health to any other environment; unless his present environment is opposed to his constitution to a greater degree than any other environment that can possibly be related to him (*vide absolute health below*).*

This is self-evident.

Conclusion

The use of any adjective which may attempt to indicate the degree of health enjoyed by an individual must therefore clearly reveal whether it is considering him in relation to his present, average, most favourable, or most unfavourable environment.

MORE DEFINITIONS

A term is now needed to define the state of well-ill-being of an individual whose gradation of health is greater than the mere absence of sickness.

Absolute Health

When at any one time an individual is on top of his present environment without depletion of his mental and physical reserves (i.e. the total man tops the total environment) he might be said to be in *Absolute Health*.

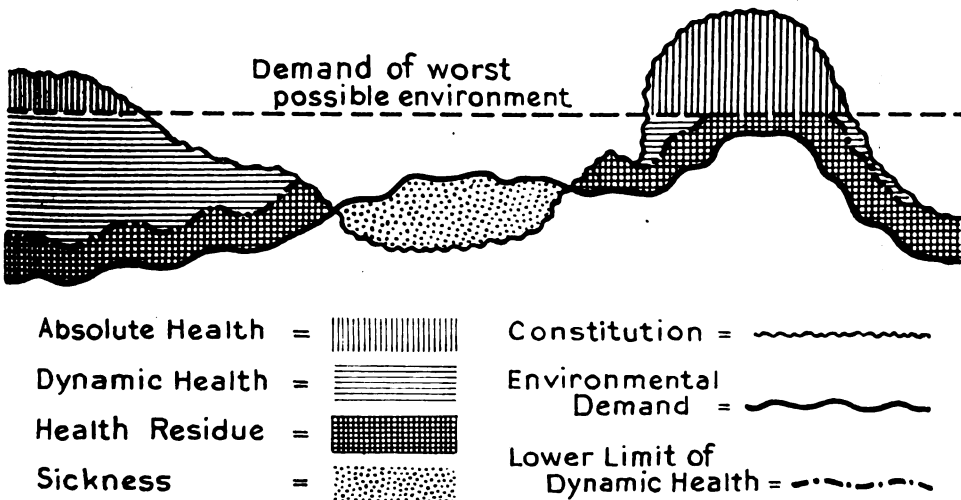
By mental and physical reserves are meant the additional stamina to sustain him in a conflict with the worst possible environment in which he can be placed. A man may top his environment but unless he can go on to face any possible environment that can be predicted for him, he is not in absolute health.

To say that a man is in absolute health without reference to time is to relate him to his *average* environment, and to say that he tops it without depletion.

Here it is important to suggest that the term positive health may be unfortunate, for it necessarily implies the presence of negative health elsewhere. Now, health is positive as opposed to sickness which is negative. In the public mind, negative health is synonymous with mild sickness and positive health must therefore mean to them merely health. Also, the users of the term positive health do not wish to imply that negative health is synonymous with sickness but with the mere absence of disease.

There is therefore a need for a term to cover the middle gradation of health to indicate that we are in the presence of something greater than the absence of sickness. I would suggest **DYNAMIC HEALTH**. But the need for such a term may not exist at all as I hope to show later.

(If we now choose to plot the curve of a given constitution against that of the environmental demand made upon it, we may see this picture.)



STILL FURTHER POSTULATES

A handicapped person can be in a degree of health tantamount to Absolute Health.

Argument

There are many degrees of health between the absolute and the absence of sickness (but see further argument later).

It is possible to be satisfied with a degree of health that will tide a **man** over the most unfavourable environment *likely* to occur as opposed to that which *could* confront him.

A handicapped person carrying permanent stigmata which have reached finality is in most cases unlikely to be faced with an environment as fierce as those conflicting with the whole person, because of his limits of mobility and because he is protected by the community.

If it is considered that the maimed can top his worst *likely* environment, bearing in mind the degree of protection afforded him by the community by virtue of his disability, he can attain a state amounting to absolute health.

Digression

Here we must digress to consider the method of infiltration of sickness.

Well-ill-being is like a sandy foreshore; the dry sand is the realm of health and the shallow waters are sickness. The edge of sickness is the irregular wave edge and sickness extends as far into the health zone as its farthest wave has reached. Beneath the shallow water the potentially dry sand of health still exists awaiting the receding tide.

To apply such abstract thought practically demands accurate determination of either:

- (a) the existence of health
- or (b) the existence of sickness.

It may well be that (a) will eventually be reached by a process of elimination, i.e. those elements incompatible with health will be withdrawn successively as they are determined, leaving the state of health behind.

The main difficulty at present is that the apparently simpler task of determining the presence of sickness is itself impossible. Our borderline is in fact that between *clinical* sickness and the absence of *clinical* sickness.

No doubt as our knowledge increases the clinical "edge" will creep further and further up the foreshore of well-ill-being until we are left with health as a thin, ultimate line. *Health may prove in the end to be Absolute Health, and Absolute Health the whole of Health.*

MORE POSTULATES

The stigmata of past environments may so alter a constitution that it cannot top an environment which it would have conquered if the stigmata were absent.

Thus: "The child is father of the man."

The range of adverse environments in which an individual can attain health

is limited by his personal constitution and further curtailed by stigmata superimposed upon that constitution.

Conversely, constitutional enhancement permitted by a relatively benign environment will widen the range of conquerable environments.

These are now self-evident.

Time of itself, without reference to environment has no changing effect upon constitution.

Argument

Well-ill-being was defined as the sum of constitution and environment. But time may have its own effect. Let us examine this postulate.

Time exists for the physical individual from birth to death. His constitution changes continuously during that time. Is it possible to say that the changes can be attributed in any degree to time alone?

Time is a concept like any other dimension and is for an individual merely a plane upon which succeeding environments are placed.

Without such environments it is not possible to visualize time as existing, i.e. the conception of Time depends upon the existence of environments.

The existence of environments peculiar to an individual depends upon the existence of the individual.

If our first argument re conflict be accepted it is reasonable to suppose that changes attributed to Time are in fact all changes contributed by succeeding environments. Time thus has no effect *per se*.

Self-analysis will affect Well-being.

Argument

The individual's personal observation of the clash between his constitution and environment will result in a conclusion regarding the outcome.

This conclusion then becomes part of his mental environment; implants its stigmata; and amends the outcome of conflict, e.g. a man has a permanent physical disability without pain; his environment is such that he wavers between health and sickness; his analysis suggests to him that he is more sick than healthy; he falls to the sick side of the norm.

Further Digression

This raises an interesting speculation regarding environment. The physical environment is tangible, visible, audible, palatable or scented. What of the psychological environment? It seems an impertinence automatically to suppose that thought is stored in or derived from any part of an individual's physical being or even within the three/four commonly accepted dimensions. It seems easier, once the dimensional barrier is passed, to conceive thought as being non-dimensional and available for reception by any cerebrum that "tunes in." It is thus simple to reverse the common belief that the physical environment is external and the thought-environment internal to the individual; and to picture the physical environment as being contained within a sphere, whose surface is

composed of all humanity, their physical selves facing inwards; whilst the void surrounding the sphere is the thought-universe or psychological environment, thus revealed as common to all.

Whether this concept is acceptable or not to the reader is immaterial. It must be agreed that a major portion of the total environment is indeterminable.

How then, even if we could define sickness and therefore by elimination, define Health, can we relate a constitution to something whose content is largely beyond our grasp?

FINAL DEFINITIONS

It may be as well to come down to earth and define certain other relevant terms.

Preventive Medicine

This is the study of the means whereby man can be maintained in health, i.e. free from sickness.

Sanitation

This is the practice of the external physical means whereby man can be maintained in health.

Hygiene

Hygiene was at one time sanitation, at another preventive medicine, and it cannot withdraw from these the protection of its voluminous skirt nor relegate them snobbishly to a hidden back room.

Yet hygienists quote the following Army definition of hygiene just as the fellow passenger toes the Party Line, without thought to its meaning but with a blind faith that it will lead to better things.

"Hygiene is the maintenance and enhancement of mental and physical health and efficiency and the prevention of disease" (A.C.I. 605/48).

Let us examine this definition.

Mental and physical health are the absence of mental and physical sickness.

The maintenance of mental and physical health is therefore the maintenance of the absence of mental and physical sickness.

The maintenance of the absence of mental and physical sickness can only be the prevention of mental and physical sickness, i.e. prevention of disease.

Efficiency is dependent upon health and directly variable with it.

If therefore we eliminate the redundant clauses we are left with either :

"Hygiene is directed towards the attainment of absolute health through the enhancement of health and the prevention of disease" or more simply—

"Hygiene is the enhancement of mental and physical health and the prevention of disease."

Now we need no longer feel guilty about defining hygiene and then finding that we are thrown back on the discussion of the prevention of disease; for the prevention of disease has now swollen to half the definition, as indeed it is half the battle: and it is that half of the battle which is fought on ground we know.

We can be further encouraged by the observation that factors which play a part in the prevention of disease may, by a "shift to the right" play a part in the enhancement of health (e.g. sleeping with the window open will dilute the pathogenic organisms in the air, but, this apart, appears to affect health in a more positive way). We know why they do the former but can only observe that they appear to do the latter; because in the former case we are dealing with tangible external causation and in the later case are turning the absence of sickness into a state which may have no tangible external causative factors. *Indeed, if the time is reached, as suggested above, when Absolute Health is the whole of Health, it cannot have any causation other than the elimination of sickness.*

If health were caused by bacteria or trauma, and absolute sickness by the enhancement of the absence of health, the headache would be for the clinician.

These are a few thoughts about Health and are offered as a plea for more searching and less lip-service, for the rejection of threadbare clichés and the honest examination of definitions and woolliness of expression hitherto accepted without question.

Perhaps one day when its full implications are sufficiently appreciated we can say—

"HYGIENE IS DIRECTED TOWARDS THE ATTAINMENT OF HEALTH."

I have to thank Lieutenant-Colonel J. O'Dwyer and Major M. M. Lewis for their constructive criticism and I am particularly grateful to Brigadier A. E. Richmond, The Director of Hygiene, for agreeing to this paper being forwarded for publication.

Clinical and Other Notes

SOUTHERN COMMAND MEDICAL STUDY WEEK

A RECENT Southern Command Medical Study week was held at the Depot. The objects were as follows:

- (a) To study medical tactics in the form of a cloth model exercise, on Divisional level. Some problems on Corps level were also included.
- (b) To become acquainted with the latest developments in Field Medical Units and their rôle in the field.
- (c) To introduce lecturers who were experts on special aspects of medical administration, hygiene or other subjects.

It was felt that there was a great deal of hidden war experience amongst many officers of the Corps which should be widely known, and that the memory of such experience would soon fade and be lost unless it was made use of at once.

The following opinions were expressed, and conclusions reached at the Exercise.

A. MEDICAL TACTICS

(1) The study of medical tactics brought out the fact that the excellent existing pamphlet on which medical tactics are based "R.A.M.C. Training Pamphlet No. 2" published in 1943 is now out of date.

This is due to the fact that the A.M.D. Committee on Post-War Medical Organization has produced changes in the organization of many field medical units with in some cases an alteration in function.

(2) *F.D.S.*—(a) When Pamphlet No. 2 was written there were two *F.D.S.*s in each div as div tps, whereas now one *F.D.S.* is allotted to each div as army tps.

(b) The tactical handling of the *F.D.S.*s in their primary intended rôle is contained in paras 67, 77, 85, 86, 87 and 236 and diagrammatically in fig. 3. These tactics are based upon the policy that one *F.D.S.* in battle will act as a resuscitation centre for Group I casualties pending their evacuation to *C.C.S.* for operation.

This rôle has been abandoned, because it was found in practice that it was bad treatment to resuscitate wounded men and then transport them by amb car to the *C.C.S.* for operation. The alternative to evacuating wounded to the *C.C.S.* for operation, was to bring forward the operating facilities to the *F.D.S.* This plan, while ideal from the early operation point of view, was not satisfactory for the following reasons:

- (i) It meant that surgeons were working in conditions often unsuitable for good operative technique, such as insanitary surroundings, enemy shelling, gun fire, etc.

(ii) There were no female nursing facilities as Q.A.I.M.N.S. were not allowed to work so far forward.

(iii) The F.D.S. became partly or wholly immobilized because certain wounded men, e.g. abdominal wounds, had to be kept for eight to ten days before they were fit for evacuation. The F.D.S. being a divisional unit must not be immobilized because it becomes unable to move with its division.

(c) The F.D.S. rôle has now been changed and it is primarily intended to deal with minor sick and prevent sick wastage. It is located in the rear divisional area. Its tactical employment therefore does not comply with the instruction in Pamphlet No. 2 and this requires amendment.

(3) *Fd Amb.*—(a) The tactical handling of the Fd Amb is contained in paras 53 to 81. In para 75 it states that “the A.D.S. naturally becomes the brigade dressing station in contra-distinction to the divisional dressing station formed by one of the divisional field dressing stations.”

Again in para 79 it states “The A.D.S. will normally be sited in the area of bde headquarters and should be centrally placed in the bde area.”

Again in para 236 it says “one fd amb may be sufficient to deal with the casualties from the whole of the divisional front.”

(b) The recent change in the rôle of the F.D.S. has resulted in a change in the rôle of the Fd Amb. The employment of the F.D.S. for minor sick only has eliminated its rôle as the divisional dressing station given in the extract from para 75 above. Therefore, the employment of the A.D.S. primarily as a bde dressing station has undergone modification, and it has re-assumed its old rôle of M.D.S. This would agree with para 236 where one Fd Amb would sometimes establish a divisional A.D.S. for two or more bdes.

During the exercise, syndicates in the opinion of the Directing Staff were locating their A.D.S.s too far forward in nearly every case, sometimes within 2,000 yds of the front line, and here it is felt we must be careful that the experience in Normandy is not allowed to entirely colour our tactics. The British forces were fighting an enemy who was constantly retreating and we had pronounced air superiority. It was natural therefore that in this campaign all field medical units would be pushed well forward in anticipation of a certain advance. Such a policy if accepted as the normal may have unfortunate consequences, and we must assume that a future war will find us fighting an enemy who may be as strong in effective forces as ourselves, with equality also in air strength.

(4) Medical tactics as taught by the Staff College are laid down in Para A 2 Medical 1947 Course published in Jan 47 and this should now be taken as the basis for future training.

It is evident therefore that the existing Training Pamphlet No. 2 requires revision and it is hoped this will be undertaken without delay in order that an up-to-date textbook is available for training officers.

B. GROUP I CASUALTIES

There was generally a lack of appreciation of the meaning of the Group I casualty as laid down in para 77 (f), and this was in the opinion of the Directing

Staff due to confusion owing to the use of the expression First Priority or Priority I cases which has crept in. First Priority cases are used to denote all casualties requiring urgent operation, quite a different meaning to Group I casualties which denotes those requiring resuscitation. The necessity of triage into Groups I, II and III cases arose only because it was intended to resuscitate Group I cases at a special unit namely the divisional F.D.S. Now that the divisional F.D.S. has ceased to perform this rôle the need has gone. To overcome the confusion which exists it is considered that the Group system should be abandoned and the Priority system substituted.

First priority wounded should include all present Groups I and II.

Second priority wounded should include all Group III.

C. PSYCHIATRIC CASUALTIES

The treatment of psychiatric casualties was considered and the Directing Staff solution brought out the chief point under discussion, namely the advantages and disadvantages of treatment in either the Divisional Exhaustion Centre or Corps. The answer to this problem is that it is immaterial whether the Exhaustion Centre is located in the divisional or Corps area as long as certain conditions are fulfilled. These conditions must be present before it is possible to treat psychiatric battle casualties with success, and they are as follows:

- (a) Psychiatrist must be available.
- (b) There must be a good standard of comfort and bathing facilities, together with adequate rest and relaxation.
- (c) The site must be free from avoidable noise of gun fire and enemy shell fire.
- (d) One or more Nursing Officers are desirable.

D. DENTAL

The dental arrangements in a Corps were discussed, the employment of dental officers and the location of dental units.

There are now 21 Dental Officers in a Corps of two Inf Divs and an Armd Div, and their distribution is given below:

<i>Formation</i>	<i>Unit</i>	<i>No. of Dental Officers</i>
Inf Div	3 Fd Ambs	3
	2 Mob Fd Dent Units	2
Inf Div	3 Fd Ambs	3
	2 Mob Fd Dent Units	2
Armd Div	2 Fd Ambs	2
	1 Mob Fd Dent Unit	1
Corps	3 C.C.S.s	3
	3 Mob Fd Dent Units	3
	Max Fac Team	2
		<hr/>
Total		21

It is considered that a strong case exists for the addition of a Dental Administrative Officer at Corps H.Q. and an A.D.D.S. (Lt Col) is regarded as necessary to efficiently administer the dental units.

E. AIR EVACUATION

(1) Air evacuation of casualties in Burma and in N.W. Europe was on a large scale and it is useful to review the results. It is felt that planning for the future must be considered, and the experiences of the war must not be allowed to be lost. We do not know whether any policy for air evacuation in the future is being actually pursued.

(2) The present operational use of aircraft for the evacuation of casualties is regarded as 20 sorties a day in the Corps area. This with light planes would mean the evacuation of only 20 wounded each day and such a small number must include selected wounded requiring life-saving measures. Such a small lift will have no effect upon the evacuation problem.

(3) Air evacuation must at present be judged as a "bonus" and there must therefore exist an alternative channel of ground evacuation. The officers with experience in Burma were especially emphatic about the effectiveness of air evacuation and it is well known that this was of paramount importance. At the same time it must be remembered that this evacuation depended solely upon air superiority, and while it provides a fine example of what can be done under such conditions, it is by no means to be regarded as the normal method in any future war where air superiority may not exist at all or would not be so pronounced.

(4) We cannot therefore rely upon air evacuation alone, but must have an alternative ground channel of evacuation. This alternative channel must be 100 per cent effective and will follow the medical set up in the field as we know it.

(5) Experience of air evacuation in Burma brought out certain aspects of the problem.

The problem must be divided into:

(a) Forward evacuation.

(b) Rear evacuation from Corps to L of C or Base Area.

(a) *Forward Evacuation.*—(i) Light planes were used and helicopters would prove suitable if available in future. Light planes can only carry one case if they have to operate from strips 200 to 400 yds long. In Burma light planes were allotted for medical use exclusively, but they are in fact mobilized as the Communication Flight of aircraft allotted to Corps. Their rôle is primarily communication and secondarily medical.

(ii) It was considered that air superiority was not essential for planes of this nature in the forward area, as they would go at tree top height and fly between A.D.S. and C.C.S.—the distance envisaged would be from 10 to 20 miles. It was thought that such a plane was no more vulnerable than a motor amb. This view needs criticism by R.A.F. before it can be accepted.

(iii) The future would lead us to demand a specified number of light aircraft or helicopters allotted to a Corps exclusively for evacuation of casualties. Planes would have Red Cross markings. The whole organization might be linked to medical as an Air Ambulance Wing, the counterpart of the Motor Amb Convoy. The piloting of these planes by non-medical R.A.M.C. is an attractive

idea on the lines of the R.A. pilot officers for artillery observation planes. This proposal may be unattainable owing to administrative difficulties but could be explored with an eye to the future.

(iv) One point in the forward evacuation from A.D.S. by air must be emphasized and that is that there will be no night evacuation. All casualties brought to A.D.S. at night will have to be evacuated by road.

(b) *Rear Evacuation from Corps to L of C or Base Area.*—Up to date the evacuation from Corps medical units to the rear has always been carried out by transport aircraft which otherwise have to return empty to their base. Their rôle for evacuation of casualties is therefore a secondary one and this affects the evacuation problem.

First: The number of aircraft bears no relation to the number of casualties. There may be too many aircraft or there may be too few. The time of arrival of aircraft is also uncertain and these factors lead to administrative difficulties, to overcome which it has been found essential to establish a medical unit close to the airfield to act as a "cushion," where casualties can be held pending the arrival of aircraft.

Second: The aircraft carry out sorties from airfields at an air transport base as distinct from a medical base, and therefore either:

I. The patients require ground transport from the airfield at the air transport base to the medical base, or

II. The medical base must be located at the air transport base.

The second alternative was nearly always adopted in Burma.

Third: The transport aircraft are not protected by the Red Cross and therefore liable to be shot down by the enemy. If our air superiority was not pronounced it might not be justifiable to utilize such aircraft for casualties.

With full-scale air evacuation as existed in Burma, it was possible to do away with the gen hosps on the L of C altogether except for local bed cover. The lift was from the Corps medical units right back to Adv Base, and this allowed of the grouping of hosps in selected medical areas near airfields. The rapidity of evacuation allowed early treatment of patients and the cutting out of gen hosps on the L of C simplifies the administrative problems. It overcame the method of evacuation whereby the casualty was evacuated from one hosp to another all down the L of C chain, never spending more than a few days in each place, and so preventing any continuity of treatment.

(6) (a) Ambulance aircraft marked with the Red Cross are likely to become the normal method of evacuation of casualties in the future. At this stage it is only possible to suggest an allotment of ambulance aircraft which bears relation to known factors such as the average likely availability of aircraft, the manpower and ground organization involved. The advantages of having ambulance aircraft for exclusive use of the medical services are:

First: Ambulance aircraft can be called forward as required to evacuate a stated number of casualties. There is no delay in evacuation and the need for the medical unit acting as a "cushion" may not be necessary.

Second: Ambulance aircraft will fly from the Corps medical area direct to

the medical base. There must of course be airstrips at both of these locations. The question arises here whether it would be operationally possible to build airstrips exclusively for medical use. If this is not possible then the medical bases and areas would have to be located at the air transport base. Such a set up as the exclusively medical base at Le Treport in 1939-1940 would not be a possibility and as this was an important factor in medical policy, the feeling is that an exclusive airstrip for medical use in such a case is justifiable and must be envisaged in the future.

(b) Our recommendations as a result of discussion are as follows:

(i) *Forward Evacuation between A.D.S. and C.C.S.*—Ambulance aircraft to be allotted to Corps on the scale of 32 light aircraft (carrying one patient) or 16 helicopters (carrying two patients). Of these 32 aircraft, 20 would be airborne at one time and 12 under maintenance, and for helicopters, 10 airborne and 6 under maintenance.

(ii) *Rear Evacuation from C.C.S. to Base.*—Ambulance aircraft to be allotted to Army on the scale of one squadron of Hastings, or similar type, which carries L. 32 and S. 24. It is pointed out that three or four loads of this nature is the equivalent of a hosp ship which in comparison is extremely slow and heavy in overhead charges, crew, fuel, etc.

(7) *Summary.*—(a) Air evacuation can only be regarded as a “bonus” at present and this will continue until ambulance aircraft are allotted for the evacuation of casualties at some date in the future. This is a policy which is bound to come, it is felt, within the next ten to fifteen years.

(b) While air evacuation is a “bonus” the present ground organization for air evacuation is essential. Motor amb convoys, hosp trains and hosp ships must be mobilized on the present scale. Even when ambulance aircraft are provided it would appear that a ground organization is still necessary though this would not be needed on anything like the present scale. The reason this ground organization would still be required is because aircraft may be unable to fly owing to bad weather, and enemy air superiority may make the operation too dangerous. It is, however, anticipated that the Geneva Convention will agree on the necessity for allowing Red Cross protection for ambulance aircraft and at medical airfields.

A dual organization for evacuation is therefore always necessary—and such an organization must of necessity prove expensive.

It would be a difficulty with our present knowledge to say what exact number of medical transportation units would be necessary in any future war if ambulance aircraft could be counted upon to carry out the major rôle of evacuation, but thought must be given to this problem to enable a balance to be struck.

(c) A suggested scale of ambulance aircraft to meet the requirements of evacuation in Corps and Army is given.

F. TACTICAL EMPLOYMENT OF THE Fd AMB—BATTLE DRILL

(1) A period of study was devoted to Battle Drill of the Fd Amb. Battle Drill is the term used for the tactical employment of the Fd Amb in its simplest form, and is taught on the flat cloth model.

The conclusions come to are most easily seen by reference to the accompanying diagrams and notes.

It is important that this Battle Drill training should be included in the R.A.M.C. training pamphlets. As far as is known this has not been done previously.

(2) Three situations were studied:

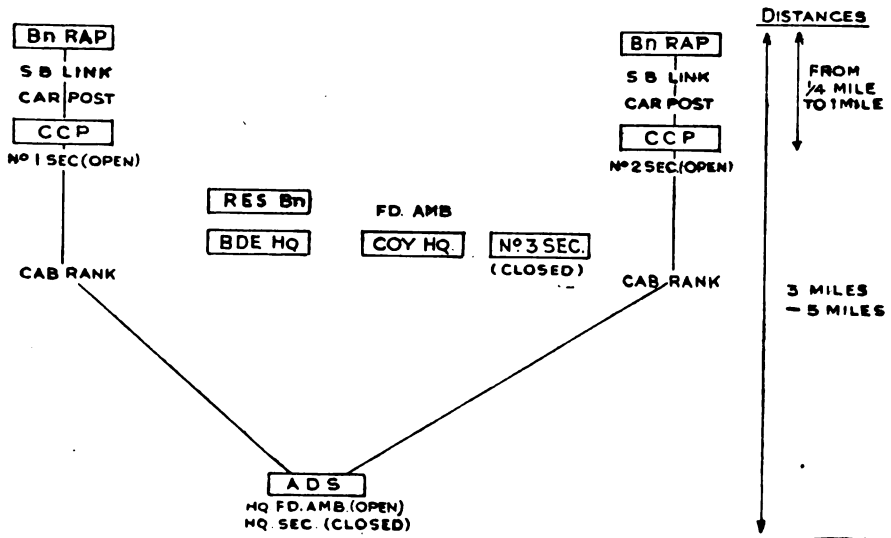
I. Fd Amb in Action.

II. Fd Amb in Attack —Phase I
Phase II

III. Fd Amb in Withdrawal—Phase I
Phase II

I. Fd Amb in Action

The tactical layout here is in its simplest form and depicts the employment of the Fd Amb in its normal rôle of supporting an Inf Bde in action.



NOTES.—(1) The CCP will be sited between ¼ to 1 mile behind the RAP and out of range of enemy mortar fire.

(2) The motor amb car at the Car Post between RAP and CCP will be sited under cover if possible and will be camouflaged.

(3) Drivers of motor amb cars must be familiar with evacuation routes at all times. To ensure this they will often be employed between limited distances, for example: RAP to CCP; or CCP to ADS.

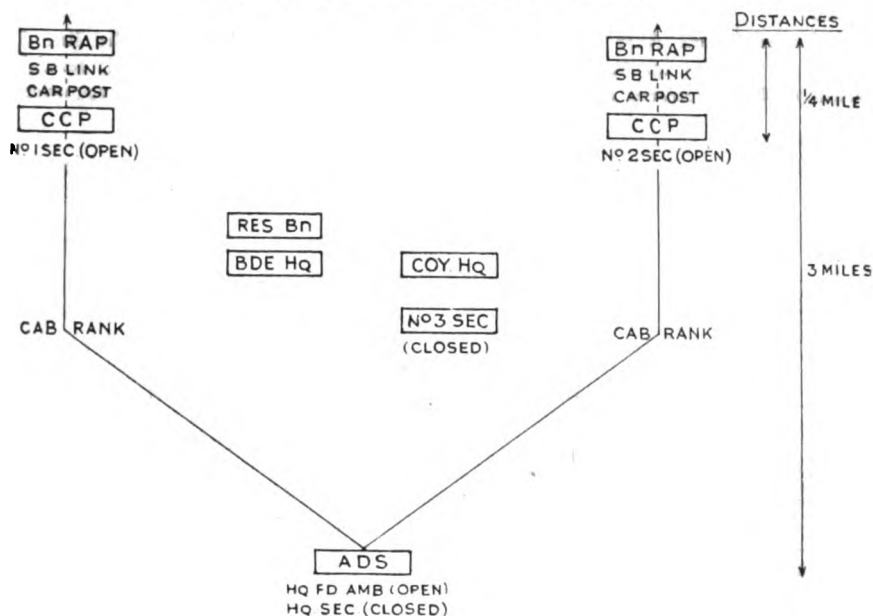
(4) A Cab Rank may be located on the evacuation route between the CCP and ADS and consist of one or more motor amb cars. As one motor amb car from the CCP passes the Cab Rank, one motor amb car goes forward to CCP and takes its place.

(5) Fd Amb Coy Comdr will be at Bde HQ in close liaison with Bde Major and Staff Capt.

(6) The HQ Sec at ADS will open up if the volume of work demands but otherwise will remain closed and can be utilized if required to open an additional CCP.

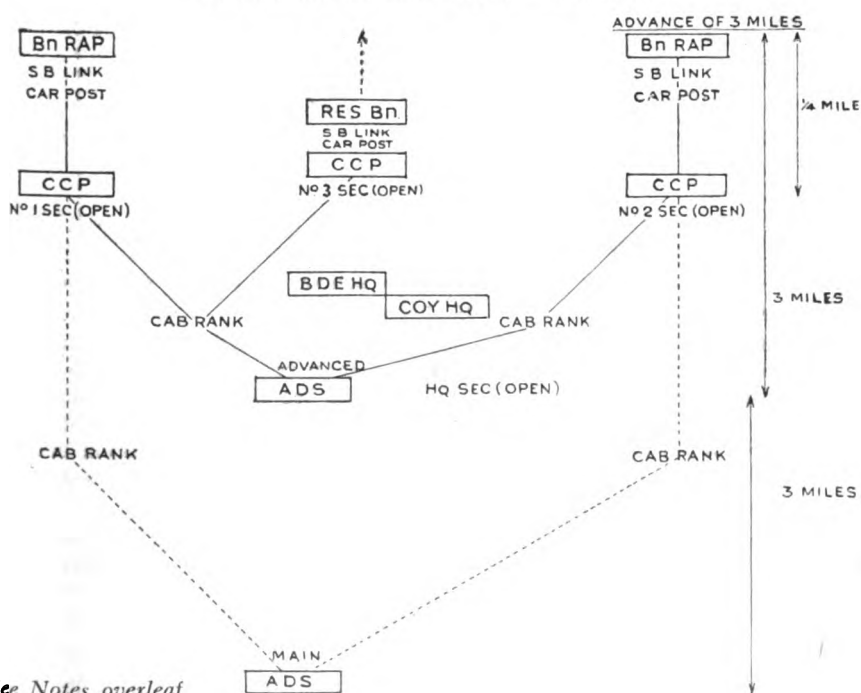
(7) The Dental Team at HQ Fd Amb will be used: (a) To render first aid treatment to Max Fac Cases. (b) To assist in general duties at ADS, e.g. Dental Officer may act as Evacuation Officer.

II. FD AMB INF DIV IN ATTACK — PHASE I



- NOTES.—(1) CCPs and the ADS must be positioned well forward.
 (2) Secs must advance and keep in touch with the Bns they are supporting.

FD AMB INF DIV IN ATTACK — PHASE II

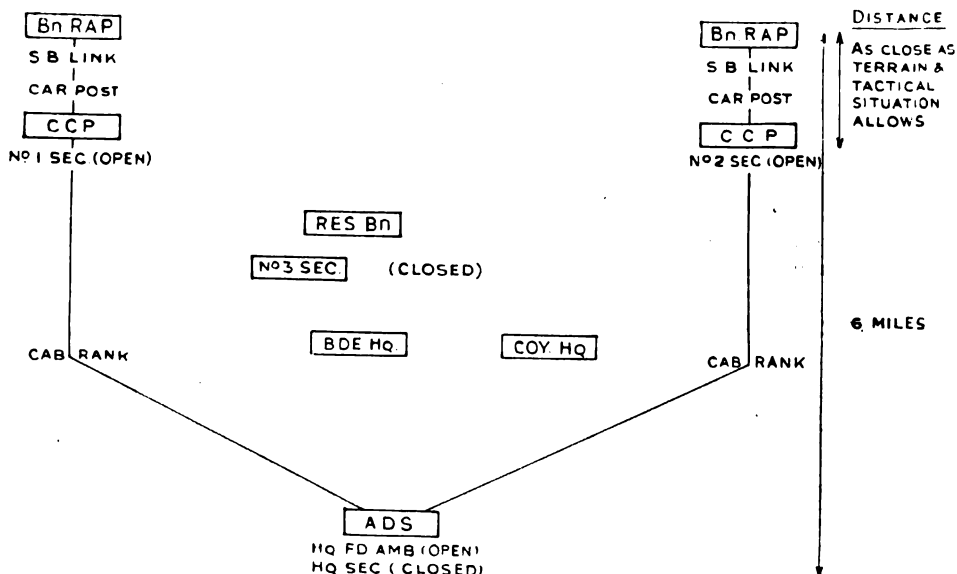


See Notes overleaf

NOTES.—(1) Bns in action have advanced 3 miles and reserve Bn of Bde is continuing advance.

(2) An advanced ADS is opened when the attack has advanced the line 3 miles. The HQ Sec moves up to open the advanced ADS while HQ Fd Amb remains open at Main ADS and moves up to join HQ Sec when patients have been evacuated.

III. FD AMB INF DIV IN WITHDRAWAL — PHASE I



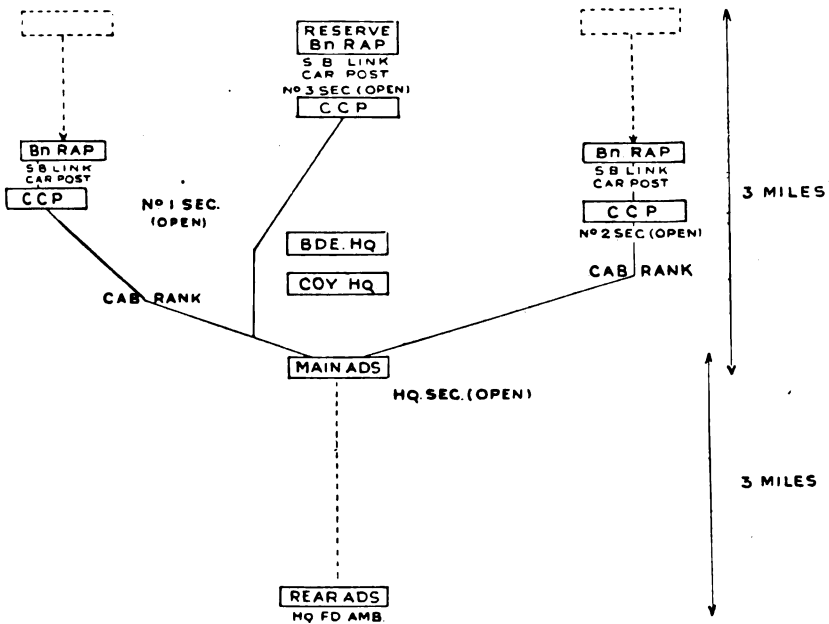
NOTES.—(1) Secs will be fully deployed in support of Bns to collect all casualties quickly in order to prevent them falling into enemy hands.

(2) CCPs will be as close to RAPs as the terrain and tactical situation will allow in order to reduce distance and so speed up evacuation from RAPs as much as possible. Secs will be prepared to withdraw quickly and the Sec will form dets which will leap frog each other. The new Fd Amb organization provides only 3 Secs as compared with 6 Secs in the old Fd Amb, and it is in a situation such as a withdrawal that the loss of 3 Secs becomes apparent. In place of providing Secs to leap frog each other, the Secs must be split into dets which will leap frog each other.

(3) Sec Officers will withdraw their Secs on their own initiative in conformity with withdrawal of Bns and will not await orders from the Coy Cmdr. In certain cases Secs may be placed under comd Bns for purposes of withdrawal.

(4) The ADS will be positioned well back—6 miles behind front.

FD AMB INF DIV IN WITHDRAWAL — PHASE II



NOTES.—(1) Bns previously in action have withdrawn 3 miles and reserve Bn is now in action.

(2) All 3 Secs are open and evacuating from Bns which they are supporting.

(3) The HQ Fd Amb withdraws first in order to get the heavier equipment and majority of vehicles away and open a rear ADS, HQ Sec is open at the Main ADS site until the HQ Fd Amb has opened the Rear ADS.

G. FD AMB IN APPROACH MARCH

(1) *Fd Amb with Inf Bde of Inf Div.*—Training Pamphlet No. 2 contains the following statements:

(a) Para 60: "The field ambulance when brigaded should occupy a position in the brigade line of march which will enable the unit to open an advanced dressing station immediately contact is made with the enemy. This implies that the field ambulance should never occupy the tail of the brigade column, but should normally be placed behind one of the leading battalions."

(b) Para 260 (a): "It is thus important that the field ambulance should not be placed in the rear of the brigade column but should occupy a position as close as possible behind the leading battalion of the main body."

(2) The opinion expressed was that these statements were not in fact correct, and that no Bde or Div Comdr would agree to the Fd Amb being positioned as far forward as stated, i.e. "behind the leading battalion of the main body." The Comdr must first win his battle and he does this by giving priority to his infantry and gunners.

(3) The following are the principles involved in the positioning of the Fd Amb:

(a) There must be a Sec ready to receive casualties when the leading troops go into action. A Sec should be located behind leading bn and may move under orders of OC Bn.

(b) The Coy less Sec should be behind Bde HQ.

(c) The O.C. Fd Amb should travel with Bde HQ.

(d) The HQ Fd Amb should not be further back than immediately behind Fd Regt R.A.

(4) The position of the Fd Amb is given diagrammatically:

FD AMB WITH INF BDE OF INF DIV ON APPROACH MARCH

Recce Sqn. — A Bn. — Sec Fd Amb. — B Bn. — C Bn. —
Bde HQ. OC Fd Amb. — Coy Fd Amb less Sec. — R.E. — Fd Regt
R.A. — Fd Amb less Coy. — R.A. — R.E.M.E. — R.A.S.C.

FD AMB WITH ARMD DIV

(1) The principles to be observed here are as follows:

(a) Soft-skinned vehicles are not sent into action in support of arm'd vehicles. Therefore Secs of a Fd Amb are not positioned behind the leading Arm'd Regt as in the case of the Inf Bde.

(b) The Sec will be positioned behind the leading unit with soft-skinned vehicles in the Col, for example, a bn or motor bn.

(c) In other words—Armour repels soft-skinned vehicles—soft-skinned vehicles attack soft-skinned vehicles.

(d) Fd Amb Coy should be located close to Bde H.Q.

(e) O.C. Fd Amb should travel with Bde H.Q.

(2) There are many combinations of the Armour Bde and the Inf Bde in the Arm'd Div, therefore we only show one suggested position of the Fd Amb on the approach march.

Fd Ambs of Arm'd Div on Approach March.—Sqn Arm'd Car Regt. —
Arm'd Regt. — Arm'd Regt. — Bn. — Sec Fd Amb. — Bty R.A.
— Coy Motor Bn. — R.A. — Bde HQ. — OC Fd Amb. — Coy
Fd Amb (less Sec). — Motor Bn less Coy. — R.E. — H.Q. Fd Amb.
— R.A.S.C. — R.E.M.E. — Bn.

Two special papers read at this Exercise have already appeared in the Journal:

(a) Evacuation of Wounded during Operations Involving the Use of Armoured Personnel Carriers; and (b) Air Evacuation.

THE ACUTE ABDOMEN IN THE EAST AFRICAN ASKARI

BY

HENRY B. YOUNG, M.B., Ch.B., D.P.H., F.R.F.P.S., F.R.C.S.Ed.

Late Royal Army Medical Corps

WHILE serving with the Royal Army Medical Corps in East Africa, we had the opportunity to examine numerous cases presented as “? acute abdomen.” Later, in addition to our own experience we were able to check over the actual numbers that occurred during the period July 1943 to December 1946, i.e. three and a half years, while going through the case records for other reasons.

On arrival in East Africa we had been told: “For practical purposes, perforated peptic ulcer just does not occur, and appendicitis is the last thing you think of in right iliac fossa pain.” Subsequent experience confirmed these as working dicta. There were approximately 16,000 admissions (excluding V.D.) during this time. Four (0·02 per cent) were perforations, and thirty (0·19 per cent) for some form of acute appendicitis. The total incidence of “acute abdomen” in the surgical sense was just over 0·3 per cent. These were classified as in the table below. Knife and accidental gunshot wounds were excluded.

OCCURRENCE OF ACUTE ABDOMINAL CONDITIONS

<i>Acute appendicitis</i>			<i>Perforated peptic ulcer</i>	<i>Other urgent lesions</i>
<i>Non- perforated</i>	<i>Perforated</i>	<i>Late—with abscess</i>		
18	5	5	4	Volvulus 5 Intussusception 3 Peri-colic abscess 3 (1, dysenteric) Peritonitis without focal origin 4 (Tuberculous, pneumococcal dysenteric, <i>B.coliform</i>) Ruptured spleen (spontaneous) 2 Purpura hæmorrhagica ... 1 Crohn's disease 1 Ruptured liver abscess ... 1

In addition, the appendix was removed five times (two with worms, *see below*, and one with a positive Kahn test) for chronic or recurrent symptoms—producing relief from these.

CLINICAL FEATURES AND DIAGNOSIS

Acute Appendicitis.—Frequently there was no central phase of the pain: it progressed more slowly (taking two to three days to reach the acute catarrhal phase so often seen, within twenty-four hours, in the European). Mild diarrhœa was frequently a part of the picture (the appendix lesion seeming to act as a trigger for an irritable colon which had never, however, given symptoms or signs of amœbic dysentery). Vomiting was much more rare, at the outset, than in the European.

Differential Diagnosis.—In general it may be said that 90 per cent of the cases of acute, particularly mildly acute, pain in the R.I.F. were not appendicitis, the other conditions mentioned below being much more likely to be the cause. In quite a number of cases the pain subsided and the Askari returned to duty without a confident diagnosis being made. If, however, the patient was a personal servant, European mess cook, or had lived on European rations, as some Africans did in the Middle East, then appendicitis had to be considered much more probable than if he had been fed on his own rations.

Malaria.—Various forms of malaria began with or developed symptoms and signs in the R.I.F. mainly ovale tertian, and malignant tertian, in its "abdominal" forms, when sporozoites and blood debris block the smaller vessels to the intestine. Theoretically, the headache, rigor, high temperature, enlarged spleen, and the fact that all resistance in the R.I.F. could be overcome by patient examination, should render this condition easily distinguishable, but, in practice, these features were seldom so striking and frequently blood films were the only means of a confident diagnosis. Even then, one had to be on guard against an attack of acute appendicitis stirring up a latent malaria—such malaria often being activated by trauma, surgical operation, or concurrent disease.

Amœbic Dysentery.—This not unexpectedly caused significant or presenting pain in the R.I.F. as the maximum incidence is frequently in the cæcum, and in 0.5 per cent of cases the appendix itself is directly involved. History, sigmoidoscopy, the search for entamœbæ in the stools and scrapings from lesions should help, and, in a few, injections of emetine relieved the condition and cleared up a doubtful diagnosis. Severe appendicitis did occur in a few who had muco-pus, but not entamœbæ in the stool.

Bilharzia.—*S. hæmatobium*, particularly when involving the lower end of the ureter or peri-ureteral region frequently gave pain in right lower loin or groin, very difficult to distinguish from appendicitis. This was not colicky, and had no relation to stricture of the orifice—as tested by ease of entrance of a ureteric catheter—such stricture seldom being found even if the orifice was heavily involved. Cystoscopy was the method of diagnosis. *B. hæmatobium* eggs have also been found in the appendix at operation. In those from the Sudan or the central parts of Nyasaland, intestinal infestation with *S. mansoni* had to be borne in mind as a possibility.

Worms.—In the appendix, these may have accounted for a number of the evanescent syndromes. Two were observed at operation—one, a round worm, and one a 3 in. segment of tapeworm.

Peri-colic Abscess.—Three cases gave the symptoms and signs of appendicitis with abscess. One proved to be due to amœbic dysentery, the others probably were, but without entamœbæ in the pus. An abscess of considerable size could be present with minimal symptoms. *S. mansoni* was found in the stools of one case.

Appendicitis with Perforation.—In the African, perforation could take place with fewer dramatic signs than in the European. The condition tended to be more lethal, two out of five dying.

Appendicitis with Abscess.—This was very similar to that seen in the European and was readily diagnosed.

Perforated Peptic Ulcer.—This presented the usual features but was less dramatic in onset and progress; the diagnosis was therefore made later—one to three days—without the drastic effect this would have had on mortality in the European. One of the four died. A further difficulty was that any symptoms suggestive of ulcer were usually vague and could be discounted, as more likely to be due to amœbic dysentery involving the transverse colon.

Volvulus.—Usual features were presented. Two were of the pelvic colon; a third, also here, was caused by a band. The fourth and fifth were of the ileo-cæcal region. Clinically partial or temporary volvulus of the pelvic colon was not infrequent—giving rise to colicky pain, constipation, the cessation of the passage of wind, and considerable distension of the abdomen particularly the left side—with few symptoms of general upset. The African ate enormous quantities of “posho”—a kind of bulky cereal once or twice a day, and was careless about his bowel movement—a marked predisposing cause of this condition. Two or three large enemata brought about its rapid subsidence. No doubt this prophylactic treatment reduced the number of cases requiring operative interference as compared with that of the African in civil life, in some areas, at any rate.

Intussusception.—Had the usual signs. All three had a cause—a fibrous polyp, a cancer of the cæcum, and a tuberculous mass in the cæcum respectively.

Non-focal Peritonitis.—The different types found are listed in the table of classification.

Rupture of Spleen.—Two were spontaneous and, in these, the spleen was not very large.

Purpura Hæmorrhagica and Regional Ileitis.—These two cases were operative findings.

Liver Abscess.—Secondary infection caused the acute symptoms and the need for operation.

One other condition that occasionally had considerable abdominal pain as one of its features was relapsing fever. Commonly, however, patients suffering from this disease had also pain in the calves, a history of epistaxis, and a general “febrile” appearance: their abdominal symptoms corresponded to no established syndrome. Blood films, if taken, usually pointed to the true diagnosis.

SUMMARY

The “acute abdomen” in the East African soldier was thus seen to be an uncommon condition, the range of its differential diagnosis wide and not infrequently complicated or obscured by other pathology. Acute abdominal emergencies, however, did occur and, despite presenting some points of variance from the usual pictures in the European, were essentially the same. Volvulus, particularly partial volvulus not requiring operation, occurred more frequently than in British troops.

As civilization proceeds, there is a tendency for an increase in these conditions formerly limited to the European, especially appendicitis and perforated peptic ulcer. In time, no doubt, the clinical features of those diseases will approximate more closely to those seen in the European.

CENTENARY MEDICAL WEEK BUDAPEST SEPTEMBER 4-12, 1948

THE Director of Surgery attended this conference at the invitation of the Hungarian Medical Trade Union. The whole Hungarian Medical profession took part and there were about three hundred foreign delegates.—Mostly Jugoslavs, Czechs, Roumanians, Bulgarians, Italians, Poles and Austrians. About twenty-five nations were represented but not the U.S.S.R.

The various sections discussed all branches of medicine but of necessity the sessions overlapped and it was difficult to attend more than the plenary sessions and those devoted to military surgery. The scope of the former was wide: a British professor for some reason chose as his subject his analysis of the Registrar-General's mortality figures for the year 1931, and his deductions on occasions appeared somewhat strange.

The deliberations of the military surgery section were invariably interesting and were by no means limited to surgery. They ranged widely over preventive medicine—immunization against tetanus, B.C.G. vaccination, mass miniature radiography, army hygiene organization, army sport, war neuroses, gastric diseases and field service. One interesting discussion was on the advisability of making operation for hernia compulsory, 3.95 per cent of the Hungarian army intake suffers from this condition.

Perhaps the subject which led to most discussion was transfusion. Different nations described their methods of obtaining blood. Army conscription was considered by some to be the best method for obtaining blood as well as sweat and tears: the French boosted plasma: a Hungarian speaker referred enthusiastically to the Russian practice of using corpse blood, and some ideas demanded correction, such as:

“Pendant que les allemands—
malgré les expériences acquises au cours de la guerre,
espagnole—n'ont pas compris l'importance de la
transfusion du sang, les anglosaxons et surtout les
américains ont résolu le problème de la transfusion du
sang sur le champ de bataille.”

The British delegate criticized these methods and statements and outlined the history of transfusion in the British Army before and throughout the war, at home and overseas. The conditions during the desert battles were described when the enemy lagged far behind in resuscitation, how in the heat of battle, British surgeons sometimes found themselves working together with German surgeons, how the latter for the first time saw our methods and brought their wounded that they might benefit by them. Some detail was also given of the transfusion set up during the final campaign. This communication was very

well received as, in fact, were all the British observations on any subject under discussion.

The profession in Hungary has suffered from the lack of foreign influence during the war years but foreign journals are now being received again and the leeway should soon be made up. All these sessions were punctuated by heavy detonations outside the building where the Danube bridges, destroyed in the final siege, are in process of demolition and replacement, while indoors, a battery of flashlight photographers operated on the speaker from every angle.

The reception accorded to the British representative by all the nations taking part was very pleasing. The Director-General of the Hungarian Army Medical Service was a most courteous and friendly president and host. The President of the Hungarian republic himself expressed his wish to meet the British Army delegate and impressed on him that he would like confrères in England to know how great a believer he, the President, is, in congresses such as this, with all the nations gathered together in amicable discussion.

Budapest devastated in parts only, its famous bridges a tangled mass of wreckage, is rising from its ashes. Its former glories can be glimpsed, its restaurants can still give points to those of any European capital. The Tsigane fiddler supplies the mixture as before. The Corps Diplomatiques help to make a visit memorable, His Majesty's Minister and Embassy Staff are the most delightful of hosts.

The Congress ended, the delegate leaves for Vienna in a train packed with Hungarian passengers. They accompany him as far as the frontier—but no farther.

PROGRESS IN THE TREATMENT OF SCRUB-TYPHUS

*A Statement Prepared in June 1948 at the Institute for Medical Research,
Kuala Lumpur*

LAST month a scientific paper entitled "Chloromycetin in the Treatment of Scrub-Typhus" was read before the Fourth International Congress of Malaria and Tropical Medicine at Washington, D.C.

It embodied the early results of six weeks' concerted investigation by two groups of workers at the Institute for Medical Research, Kuala Lumpur, of the curative properties of a new drug, Chloromycetin, in the treatment of scrub-typhus. The authors were Dr. Joseph E. Smadel, Dr. Theodore E. Woodward, Lieut. Herbert L. Ley, Colonel Cornelius B. Philip, and Major Robert Traub, comprising a Research Unit of the U.S. Army, and Dr. R. Lewthwaite and Dr. S. R. Savor of the staff of the Institute.

This event was of deep significance to layman and scientist alike. To the layman resident in the Far East, whether civilian or serving soldier, it indicated that a once grave and often mortal infectious fever had now, in the presence of the drug, become trivial. To the scientist it marked more than a notable advance in the curative field; for the drug, chloromycetin, which is an extract of a mould, appears to provide an excellent means for treating the rickettsial diseases, of which the typhus fevers are the most widely known examples.

A glimpse of this successful collaboration in medical research may be of interest to the general public; and is perhaps its due, since it sustains such investigations by contributions from the public purse.

THE DISEASE

Scrub-typhus, known also as Japanese River Fever and the Tsutsugamushi Disease, was first conclusively shown to exist in Malaya in 1924 by the late Dr. William Fletcher, then Director of the Institute for Medical Research. His colleagues at the Institute rapidly amplified his findings. Dutch workers in the N.E.I. added their contribution. The causal organism and the mite vector were identified; the rôle of the rat was elucidated; the disease was reproduced in laboratory animals; a second form of typhus, "shop-typhus," was clearly differentiated from it, and shown to be flea-borne. Its pathology in man was studied, and found to have much in common with typhus fevers the world over; strains of some of these, from America, Australia and Sumatra, were brought to the Institute and compared and contrasted with scrub-typhus.

From the knowledge thus gained it was possible to recommend to the planting community certain preventive measures, mainly concerned with the avoidance of mites and the reduction of rats. Attempts to develop an effective vaccine failed during the pre-war period.

THE IMPACT OF WAR

The impact of war, with its stake of national survival, provided the concentrated intensive international acceleration of effort that has led to impressive advances towards the curbing of this disease.

In pre-war days the menace of scrub-typhus was largely to the planting community, throughout which the disease was much dreaded. Though less common than malaria, tuberculosis and dysentery, its critical course in most victims, fifteen out of every hundred of whom died, and many of whom remained long incapacitated, caused it to be regarded as one of the major medical hazards of those whose occupations involved contact with the countryside, especially where rats and lalang abounded.

With the outbreak of the Japanese war, and the ebb and flow of jungle warfare that followed, the Armed Forces in their scores of thousands lived and fought in jungle areas, and thus of necessity became exposed to the bite of the larval mites. To a much greater degree than in peacetime, man supplanted the rodent as a temporary host of the mite; and the incidence of the disease correspondingly soared, to reach a total figure of some 25,000 cases amongst the Allied Forces.

From the Assam-Burma theatre of war an appeal for instant aid was made to London; from the South-West Pacific theatre a similar appeal was made to Washington. Research was intensified and followed two main trends: the development of a prophylactic vaccine and of a mite-poison. Success in the former proved elusive; trials of one of the most promising were cut short by the

sudden cessation of hostilities. Success in the latter was notable. For an Australian team of entomologists, led by McCulloch, developed the most effective wartime weapon against scrub-typhus. They demonstrated that a chemical substance, di-butyl phthalate, when smeared on the clothes by an approved technique, poisoned mites; and survived considerable laundering. The use of this method in the field reduced the incidence of the disease by 75 per cent. It was later shown that another chemical, benzyl benzoate, was equally effective.

The present work with chloromycetin and scrub-typhus stems directly from the wartime efforts of British and American investigators on penicillin. The antibiotic penicillin, which has proved so important in the treatment of many bacterial infections, is a purified extract of a mould.

THE DRUG CHLOROMYCETIN

Medical research workers in Britain and the U.S.A., especially the research divisions of the large biological business houses, were not slow to explore further this new path of advance in curative medicine. Strains of moulds by their thousands were tested; from one of them came streptomycin. In 1947, Dr. Paul R. Burkholder of Yale University, U.S.A., experimented with a mould collected from soil in Venezuela; and from it isolated an extract that showed anti-bacterial properties. It was referred by him to the Research Laboratories of Parke, Davis & Co., Detroit, Michigan, where the extract was obtained in crystalline form, and named "Chloromycetin." It was subjected to preliminary trials in test-tube and laboratory animal, its range of action was explored, and methods for its quantitative estimation in blood were devised. An early finding was the protection given by it to chick embryos infected with the causal rickettsial organisms of louse-borne typhus, i.e. the "classical" devastating form of typhus.

The drug was referred to Dr. Joseph E. Smadel, Head of the Department of Virus and Rickettsial Diseases, Army Medical School, Washington, D.C., and one of America's leading virus experts, for extended laboratory trials, primarily against the viral and rickettsia agents. The investigations of the Army Medical School showed that the protective properties of the drug extended to most of the rickettsial agents including the cause of scrub-typhus and of certain virus infections; and (of prime importance) that its toxicity to animals, including man, was low.

A short visit to Mexico by Dr. Smadel and Lieut. Ley in January 1948 confirmed, in a small series, that the drug was effective in man against louse-borne typhus.

Scrub-typhus next claimed attention, since its importance had been enhanced in the post-war period by two new factors: first, the presence of Allied armies of occupation in the Far East; secondly, the spreading of the disease by the increase in numbers and dispersal of the rat population.

THE U.S. RESEARCH TEAM IN MALAYA

Through official negotiations between the respective Governments, the United States Army Medical School, Washington, sought the views of the Institute for Medical Research as to the feasibility of collaboration between U.S.

and Malayan scientists in trials of chloromycetin in human scrub-typhus in Malaya.

With the challenge of scrub-typhus still not fully answered, and with the success of wartime Anglo-American collaboration still fresh in the memory, there could be in response but one attitude, viz. *carpe diem*; and the project was warmly welcomed.

In March 1948 Dr. Smadel and four colleagues arrived in Malaya by a special U.S. Army plane, complete with two tons of equipment, jeeps, and the world supply of chloromycetin, viz. one pound; a modern argosy that was to prove of profound import to Malaya and countries adjacent to it.

Within twenty-four hours of reaching Kuala Lumpur they had settled into the laboratories set aside for them at the Institute for Medical Research, and the treatment of three early cases of scrub-typhus had begun.

Two days later all three patients had normal temperatures, toxicity had vanished, and convalescence was well on the way. When contrasted with the known severity of the disease in untreated cases, viz. the fifteen days (or more) of fever, the severe toxicity, and the liability to grave complications affecting lung and nervous system, it was immediately evident thus early in the investigation that the success in the laboratory was being fully reproduced in man; that in chloromycetin the physician now had at his disposal a powerful curative agent against scrub-typhus.

Favoured by an explosive outbreak of the disease on an estate near Kuala Lumpur, some 40 proven cases have now been treated with the drug, without a failure, by the physician of the U.S. Unit, Dr. Theodore E. Woodward, Associate Professor of Medicine, University of Maryland, U.S.A. Since in untreated cases death may occur from the twelfth day of fever onwards, the importance of early diagnosis is clear. Yet some amongst the 40 were first treated as late as the eighth day, and one notable case on the ninth day.

The drug is given by mouth, in tablet form. In the first few patients treatment continued for several days, but it soon became clear that one day's administration sufficed in most cases.

Laboratory mice are an all-important adjunct to scrub-typhus research. The considerable stock prepared for this work was rapidly exhausted as the tempo increased. Cabled requests to the Director of the Commonwealth Serum Laboratories, Melbourne, to the Director of the Wellcome Research Laboratories, London, and to U.S. Army sources in Manila for 500 mice from each met with a ready response; 1,500 arrived by air transit.

Arising from the above success, as is invariably the case in medical research, new leads have appeared, and are being followed. Not only medical findings, but entomological findings of importance have emerged; for, *pari passu* with the clinical investigations, intensive field investigations of the natural transmission of the disease have been made by the entomologists of the U.S. Army research unit (Colonel C. B. Philip and Major R. Traub) and by the entomologists of the British Colonial Office research unit now at the Institute (Dr. J. R. Audy, Mr. J. L. Harrison and Mr. K. L. Cockings).

It was particularly gratifying to the investigators that Sir Howard Florey, who had shared with Sir Alexander Fleming and Dr. E. Chain the Nobel Prize for Medicine in 1945 for their discovery and development of penicillin, accepted an invitation to visit the Institute in order to observe and discuss this spectacular unfolding of research in the field of the antibiotic drugs in which he had pioneered. More recently, Dr. J. L. O'Connor, a research worker at the Commonwealth Serum Laboratories, Melbourne, was sent by his Government to observe the progress of the investigation.

THE SUPPLY POSITION

The drug hitherto available has been a pilot lot; large-scale production is not yet in being. In fact, the supply position of chloromycetin is similar to that of penicillin in 1941, i.e. a new drug, proven qualitatively, but scarce. A time-lag in production is inevitable, though fortunately the methods now in use for penicillin and streptomycin will in principle be applicable.

Needless to add, Malaya is already negotiating with Parke, Davis & Company in this matter.

This short review suffices to record a major medical event. It indicates that the visit of the British scientists with penicillin to the United States of America in 1941 has been repaid in full measure to Malaya by this mission of the U.S. Army research unit with chloromycetin. It exemplifies that Commonwealth of Medical Research which transcends frontiers, and in so doing hastens to fruition services to humanity that would otherwise languish through isolation.

Correspondence

SIR,

The writing of the official medical history of the 1939-45 war proceeds. The raw materials out of which it must be built are the reports and the like which Headquarters of formations and units were required to send back to the War Office during the war years. These proffer in great abundance factual information which must, of course, guide the historian's pen. But these reports were addressed to the War Office and not to posterity; they tell of what was encountered and of what was done, but seldom do they reveal the reasons for action or disclose its results. They give no expression of the thoughts or feelings of those concerned.

This history, when written, must be more than a mere chronicle, it must distil wisdom out of the experience of a generation so that those who follow can, if they so wish, profit. Blood is well shed if it is to be used in such transfusion.

There must be many who served with the R.A.M.C. who can help very materially if they will but unlock the door of memory or hunt out the diaries of those days and tell of what they know. This is more particularly the case in those campaigns that ended in tactical defeat—France 1939/40, Norway, Greece and Crete—for there was much burning of papers, and all that remains

to be read is that which is deeply engraved upon the minds of those who served and endured. Then there were the relatively undramatic but nevertheless important affairs in Madagascar and Paiforce, the isolation of those in West Africa, concerning which there is but little on record.

In this building of a comprehensive and significant picture out of a great mass of apparently unrelated little bits and pieces no information is without value, information not only about matters medical but also concerning the formations with which the medical services were associated.

I shall indeed be grateful for any help that I can attract.

I am, etc.,

F. A. E. CREW.

Notes from A.M.D.

(1) EXCHANGE OF OFFICERS

AN exchange of Specialist Officers between the Royal Army Medical Corps and the Medical Corps of the United States Army has been arranged.

In the first instance two Specialists will go to America for a period of six months and will be employed professionally in Military Hospitals in the U.S.A.

It is understood that the first two will be a Physician and a Surgeon who will exchange with officers of similar experience and status from America.

Specialists in any branch of professional work are eligible for selection and it does not follow that the next to be selected will necessarily be a Physician or a Surgeon.

It is obvious that this exchange will be of very great value and that the officers who go to America will have invaluable experience—both professional and otherwise.

(2) SENIOR APPOINTMENTS

(a) Major-General W. Foot from D.D.M.S. Eastern Command to retirement.

(b) Major-General K. A. M. Tomory from D.D.M.S. Scottish Command to D.D.M.S. Eastern Command.

(c) Brigadier J. M. Macfie from D.D.M.S. East Africa to D.D.M.S. Scottish Command.

(d) Colonel J. P. Macnamara from A.D.M.S. Canal South District to D.D.M.S. East Africa.

(3) HONOURS AND AWARDS

THE King has been graciously pleased to give orders for the following appointments to the Most Excellent Order of the British Empire, in recognition of gallant and distinguished services in Palestine during the period September 27, 1945, to March 26, 1946:

To be Additional Members of the Military Division of the said Most Excellent Order: Major (temporary) Walter John Goulding Brunt (76845), Royal Army Medical Corps.

The King has been graciously pleased to give orders for the following promotions in, and appointments to, the Most Excellent Order of the British Empire, in recognition of gallant and distinguished services in Palestine during the period September 27, 1947, to March 26, 1948:

To be Additional Officers of the Military Division of the said Most Excellent Order: Lieutenant-Colonel (temporary) Gerald Hugh Campbell Ovens (359263), Royal Army Medical Corps.

To be Additional Members of the Military Division of the said Most Excellent Order: Major Percival Robert William Harvey (75328), Royal Army Dental Corps.

The King has been graciously pleased to approve that the following be Mentioned in recognition of gallant and distinguished services in Palestine during the period September 27, 1945, to March 26, 1946:

Royal Army Medical Corps

Maj. (temp.) J. A. G. Horton (297492). Maj. (temp.) A. Steer (75479).

The King has been graciously pleased to approve that the following be Mentioned in recognition of gallant and distinguished services in Palestine during the period March 27, 1946, to September 26, 1946:

Commands and Staff

Brig. (temp.) G. S. McConkey, O.B.E. (1249).

Royal Army Medical Corps

Col. W. H. O'Riordan (5283). 14071051 Cpl. S. Hill.

7345611 W.O.II N. D. Shakespeare. 14872409 Cpl. A. Youseman.

The King has been graciously pleased to approve that the following be Mentioned in recognition of gallant and distinguished services in Palestine during the period September 27, 1946, to March 26, 1947:

Commands and Staff

Col. A. J. Beveridge, O.B.E., M.C., M.D. (8619).

Royal Army Medical Corps

Lt.-Col. R. R. Leaning (41300). 7259677 W.O.I J. H. Sayle.

Maj. A. D. Young, D.S.O. (128689). 15001292 W.O.II J. C. Topple.

Maj. (temp.) J. T. Landau (99202). 14136152 Sjt. W. T. Witcomb.

Maj. (temp.) S. A. Lane (99210). 19009851 L/Cpl. D. S. Allen.

Capt. C. G. H. Bourhill (365075). 14112527 L/Cpl. A. Griffin.

Capt. A. C. Cobban (345720). 14156049 L/Cpl. D. H. Whitehouse.

Capt. D. Peebles (356633). 14113220 Pte. D. Duffy.

7261544 W.O.I R. S. Murlis.

Queen Alexandra's Imperial Military Nursing Service

Prin. Matron (temp.) F. M. Percival, R.R.C. (206380).

Sister I. L. Currie (355026). Sister M. C. McGlinchy (371340).

The King has been graciously pleased to approve that the following be Mentioned in recognition of gallant and distinguished services in Palestine during the period March 27, 1947, to September 26, 1947:

Royal Army Medical Corps

Maj. W. R. Lamb, M.C. (122729). 7520334 W.O.II V. A. Spilstead.

Capt. K. W. Leech (342921). 14107570 L/Cpl. H. Rowley.

Capt. E. S. Machell (358617). 14106861 Pte. S. Crewe.

Capt. H. R. Turner (359974). 19113938 Pte. J. R. Hall.

Capt. (temp.) W. A. Reynolds (317653). 1412585 Pte. S. Ross.

Queen Alexandra's Imperial Military Nursing Service

Sister N. McBrierty (371191).

The King has been graciously pleased to approve that the following be Mentioned in recognition of gallant and distinguished services in Palestine during the period September 27, 1947, to March 26, 1948:

Royal Army Medical Corps

Lt.-Col. (temp.) S. Ward (73687).	Capt. R. A. L. Wenger (378840).
Maj. (temp.) A. S. Douglas (356077).	Capt. (temp.) I. A. MacGregor (371132).
Maj. (temp.) D. F. Freebody (371116).	Capt. (temp.) W. A. Reynolds (317653).
Maj. (temp.) J. G. Hoult (306331).	7263304 W.O.I (actg.) T. B. Tobin.
Capt. M. P. Durham (378395).	7520334 W.O.II V. A. Spilstead.
Capt. G. L. MacKay (371140).	14887162 Sjt. C. F. A. Lloyd.
Capt. C. G. Teverson (378326).	19067001 Pte. D. J. Swann.

Queen Alexandra's Imperial Military Nursing Service

Matron (actg.) A. McGeary, A.R.R.C., M.B.E. (206315).	Sister E. I. Mitchell (355787).
Sen. Sister (temp.) M. A. Lawson (206284).	Sister B. Williams (356111).

The King has been graciously pleased to approve that the following be Mentioned in recognition of gallant and distinguished services in Palestine during the period March 27, 1948, to June 30, 1948:

Royal Army Medical Corps

Lt.-Col. (temp.) J. C. Lambkin (73562).	14156623 S/Sjt. (actg.) K. S. Stones.
Maj. (temp.) Miss E. C. Brownlie (356087).	14098628 Cpl. B. T. Bellingham.
Capt. A. Batty-Shaw (363774).	14126779 Cpl. A. R. M. Bewick.
Capt. M. P. Durham (378395).	19029787 Pte. R. Caine.
Capt. M. M. Herbert (378289).	19104886 Pte. N. Hooker.
Capt. H. A. F. Mackay (286147).	14151522 Pte. L. Paul.
Lieut. W. Hayhurst (359626).	19078413 Pte. K. J. Punter.

Queen Alexandra's Imperial Military Nursing Service

Sister M. A. Ross (348089).	Sister J. Tozer (206491).
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Reviews

A SURGEON'S GUIDE TO LOCAL ANÆSTHESIA. By C. E. Corlette, M.D., Ch.M.Syd., F.R.A.C.S. Bristol: John Wright & Sons, Ltd. Pp. 355. 200 Original Illustrations. Price 30s.

This is a practical book written by a general surgeon of great experience for surgeons rather than specialist anæsthetists. In it are described, fully and clearly with the help of numerous very excellent diagrams, the indications, limitations and technique of local anæsthesia and the part it plays in minimizing hæmorrhage and in shock prevention.

A great deal of sound practical surgery is discussed—mainly amplification of standard procedures which the author has found useful and the reader will find interesting and instructive.

Surgeons inexperienced in the art of local anæsthesia and those in outposts where general anæsthesia may be a problem will find what they need in this book. Army surgeons would do well to read it and retain it as a work of reference.

O. F.

THE SKIN DISEASES. A Manual for Practitioners and Students. By James Marshall, M.D., B.S. London: Macmillan and Co. Ltd. 1948. Pp. 363. Price 30s.

In his preface to this work the author states:

"Dermatology may not be a science but it is not a mystery, and I hope that I shall have been able to provide a guide to procedure which will tempt some to try their hands in the treatment of the skin diseases which are all too often considered only a waste of time in general practice."

He is to be congratulated on producing a book which clarifies much that is occult to many, and one in which the information given is clear, concise and very readily accessible. The army medical officer will welcome the integration of dermatology with syphilis which the book provides, and a summary of the rashes of infectious fevers is an added asset. A study of the basic principles set forth in the first few chapters will lead to a ready acquisition of ability to describe lesions accurately and formulate rules for their investigation and treatment. The book is profusely illustrated and many of the photographic reproductions are excellent. J. B.

MODERN TREATMENT YEARBOOK, 1948. Edited by Sir Cecil Wakeley, K.B.E., C.B., D.Sc., F.R.C.S. London: The Medical Press. Pp. 344. Price 15s.

This annual publication is a useful work of reference in the methods of modern treatment requiring to be known by the general practitioner. All branches of the practice of medicine are represented, and it gives detailed instructions by accredited authorities for the management of the conditions selected. Thirty-eight subjects are dealt with in this volume, and each can be regarded as equivalent to a post-graduate lecture. This year's issue maintains the traditions of the series in keeping the busy or outlying practitioner or medical officer in touch with the practical applications of the latest research in their bearing on diagnosis and treatment. J. B.



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THE PURIFICATION OF WATER SUPPLIES ON FIELD SERVICE : A Retrospect

BY

Major STANLEY ELLIOTT, O.B.E., T.D.

[Received February 1, 1949]

THE story of water purification in the Field as far as 1925, has been ably told in the Official History of the War (1914–1918), in an article by Lt.-Col. J. A. Anderson [1] and in a further one by Colonel Sir William Horrocks [2]. It is the object of this article to continue the story to the present date, not dealing with treatment under civil or peace conditions, but confining the subject to Field conditions only.

Lt.-Col. Anderson's general principles of treatment were "Clarify by alum, sterilize by chlorine." Sir Wm. Horrocks advocated preliminary clarification followed by (a) ordinary chlorination, (b) ammonia-chlorine, or (c) superchlorination followed by dechlorination.

These general principles have been proved, during many years of civil and military practice, to be thoroughly sound; and, therefore, they are still the basis of our treatment of water supplies.

Lt.-Col. Anderson referred to many points which needed investigation and, during the last twenty-five years, many scientists have been studying the matter with generally successful results. Improvements in equipment and methods have also been effected during that period. One can say with confidence that our present methods in the Army leave nothing of great importance to be desired, except the elimination of the human element. This is not a practical proposition as the treatment cannot be made completely automatic under Field conditions.

The story of recent developments is so complicated that it is best told under

subject headings and not in chronological order, so it seems best to commence with the individual and work up to the larger installations.

ARRANGEMENTS FOR THE INDIVIDUAL SOLDIER

In the event of men being separated from their unit, either by being lost after battle or sent on patrol, some arrangements must be made for them to purify water from streams, etc., with the simplest and lightest apparatus. Although the number of men so affected is small and an epidemic caused by faulty methods of water purification would not be so devastating as with large bodies of troops, yet it is obvious that only really good and foolproof methods of purification must be employed. Every man saved from hospital treatment in an Army is an asset instead of a liability, so we must take great pains to make all drinking water as safe as possible.

Before 1939, sodium acid sulphate (bisulphate of soda) tablets were issued to the troops, and the addition of one tablet to a quart of water in a water bottle made the water so acid (pH value about 3) that organisms were killed. The tablets were corrosive and deliquescent and it is a debatable point whether they killed cysts and ova. In order to make the water palatable, saccharin and oil of lemon were incorporated in the tablets.

In 1938, some Italian tablets called "Steridrols" were received for examination at the Royal Army Medical College. They consisted of Halozone, borax and salt. From that idea the sterilizing outfit for use with water bottles was devised and introduced by Major-General D. T. Richardson, Director of Hygiene, into the Army during the early part of the 1939-45 war. The outfit comprised a small tin box with hinged lid, approximately 2½ in. square by 1 in. deep, with instructions on the inside of the lid. The box contained two bottles hermetically sealed with waxed corks and screw caps and made of thick, practically unbreakable, glass. One bottle contained the white sterilizing tablets of Halozone and sodium carbonate with salt as a filler to make a 0.2 gramme tablet. The other bottle contained blue tablets of dyed "hypo" with salt as a filler to make a 0.1 gramme tablet for dechlorination and removal of taste. One tablet dissolved in a quart of water yielded four parts of free chlorine per million, a proportion considered sufficient to allow for three parts for deviation and one part of chlorine for sterilization. After some time, it was found that tablets made by certain manufacturers lost much of their available chlorine after a year's storage, so the amount of Halozone was increased by about 75 per cent and the proportion of hypo was also increased. These outfits were widely used throughout the war.

Towards the latter end of the war (1944) the Americans introduced Bursoline and later Globaline tablets made from iodine, glycine hydriodide and acid phosphate for sterilizing water in canteens (i.e. water bottles). They were used to a certain extent by our troops, especially in South-East Asia. They coloured the water yellow and the phosphate caused a turbidity of calcium phosphate with hard waters, but they sterilized the water and it was claimed that they killed cysts of *Entamoeba histolytica*. The question has not yet been decided whether their continued use is likely to cause iodism in

consumers and opinion appears to be divided as to whether they retain their iodine on storage in the tropics.

Several articles by Chang and others [3] tended to show that under certain circumstances, cysts of *Entamoeba histolytica* were not killed by chlorine and it was considered that these cysts might be present in water contaminated with the faeces of people with amœbic dysentery. Experiments were undertaken at the Royal Army Medical College to deal with the matter. It was found that a filter bag could be made from a specially woven cloth ("chain weave") which would clarify water without the use of alum and at the same time remove most, if not all, cysts in the water. Although new filter bags allowed the passage of a few cysts—after being used a few times, all the cysts were retained by the cloth. The bag is folded and fitted into a waterproof bag measuring 5 by 4 in. by 1 in. thick and weighing about 4 oz. when dry. As the cloth is impregnated with copper anti-mould composition, it can be packed and stored wet. Its use is very simple, it is to be thoroughly wetted in the stream, filled with water, suspended from a branch of a tree or similar object, then about a pint of water is allowed to run to waste, to wash dirt off the outside and the water bottle placed beneath it. The bottle is filled in about five minutes. Dirty filter bags are turned inside out, washed in the stream, and then turned back again.

Thus the individual soldier can clarify with the Millbank filter bag, sterilize with the tablets and render safe to drink, most naturally occurring waters.

Many methods were devised during the 1914–18 war to effect sterilization of water for individual soldiers, the most successful being the water bottle and scoop method. Four scoops of water sterilizing powder are mixed with water and filled into a water bottle which is then filled and shaken. One scoopful of this suspension in a quart of water will give four parts of chlorine per million so long as the water sterilizing powder has not deteriorated. The method is more suitable for a small body of troops than for individuals.

Several times, during this period, efforts were made to make tablets from bleaching power or water sterilizing powder, but without success as the tablets were friable and fell to pieces very readily.

While dealing with individual methods, it seems appropriate to add a note about water bottles. There is an interesting article by Dunbar Walker [4], in which he traces their history from the old leather black jacks, through the wooden bottles used in the Peninsular and Crimean wars to the canvas-covered tin bottle used in the second Afghan war. The enamelled iron bottle with a felt cover served many years to the present date, but the American pattern is now slowly supplanting it.

ARRANGEMENTS AND EQUIPMENT FOR SMALL BODIES OF TROOPS

A small filter was developed about 1940 at the Army School of Hygiene and was designed to provide filtered water for a platoon or small body of troops on patrol for several days such as occurred in South-East Asia during the 1939–45 war. A stirrup pump and small Meta-filter are combined and carried in a carrier similar to a golf-bag. The whole weighs about 10 or 12 lb.

and can produce a maximum of 40 gallons of filtered water an hour, enough for 160 water bottles. This treatment, combined with sterilization with tablets or the water bottle and scoop method provides a safe potable water for, say, a platoon.

A less portable filter, weighing about 300 lb., was developed about this time, but it was seldom used.

EQUIPMENT FOR UNITS SUCH AS BATTALIONS

When the Army was mechanized, the horse-drawn water cart became obsolete and a water tank truck was devised in time for the 1939-45 war. Furthermore, trailers with pumps, filters and a storage tank were designed for attachment to lorries. Most of this work was carried out at the Army School of Hygiene by Major E. F. W. Mackenzie and later by Major F. C. Hilton-Sergeant, in conjunction with other branches of the Service.

Before leaving the horse-drawn water cart with its cloth filters and clarifying powder alum, one should say that they did yeoman service throughout the 1914-18 war and afterwards. The clarifying powder was prone to decompose and become useless and a committee of chemists eventually prevented that by the incorporation of an equal weight of kieselguhr with the alum and soda in the powder.

A further improvement to the bleaching powder was made on the suggestion of Aumonier and Elliott [5]. Bleaching powder had hitherto been most unstable, especially in the tropics, mainly on account of its moisture. The incorporation of quicklime prevented this trouble and I.C.I. produced "water sterilizing powder" with 25 per cent available chlorine. This powder has stood the test of time and is in present use.

The filter cloths of the horse-drawn water cart gave a certain amount of trouble in that they tended to be cut by sharp stones, the water duty men failed to fold them correctly and they often failed to clarify the water completely. When the Meta-filter came on the market, it was tested in 1930 at the Royal Army Medical College and was found to remove all cysts of *Entamoeba histolytica* and over 99 per cent of organisms in the water, besides removing clay and other particulate matter completely. The filter depends on the formation of a layer of kieselguhr on the outside of a coarse strainer made of a pile of metal washers spaced apart about 3/1000 of an inch, the kieselguhr being the actual filtering medium. When the filter blocks it is only necessary to stop pumping, release the pressure and the bed of kieselguhr falls away from the strainer. On resuming pumping, the bed reforms without the surrounding blocking layer and after a short interval, the filtrate runs quite clear. Cleaning out the filter is easy, as on releasing the pressure the bed falls away and on opening a valve at the bottom of the filter, the dirt and kieselguhr can be flushed out. This compared favourably with the skill and trouble required in cleaning the cloths of the old filters and, of course, the deposition of the filter bed, being automatic, is practically foolproof. About 1935, another filter, the Stellar was marketed and differed slightly in design, but not in performance, from the Meta-filter. The strainer, instead of

comprising a pile of washers, is a spiral of wire on a metal former with interstices of the same width as the Meta-filter. Both these filters have withstood the ravages of war and peace and very few replacements have been necessary.

The water tank truck, fitted with a 200-gallon tank, with two filters, two hand pumps and a power-driven Mono pump was issued at the rate of one per battalion in place of two horse-drawn carts, in time for the 1939-45 war. These trucks proved very efficient and simple to use and have lasted well. Chlorination of the water in the tank was difficult at first as the baffles which were necessary to prevent surging of the water prevented even mixing of the water sterilizing power, but the difficulty was overcome when plungers were provided.

The water tank trailers which held 150 to 180 gallons in their tanks were fitted with cloth filters at first, but during the war these were gradually changed to metal filters. The trailers gave a certain amount of trouble as the wheels were not of standard size and no spare tyres were carried, so that when a puncture occurred, the trailer had to be jettisoned.

Just before the end of the war an airborne trailer was produced. The tank held 100 gallons and was filled by hand-pumping through one large metal filter, the water being chlorinated by hand. These trailers could be towed by jeeps and with the jeep, fitted into an aeroplane.

Before and during the 1939-45 war, much work was carried out at the Royal Army Medical College and the Army School of Hygiene on bleach substitutes and various methods of sterilizing water.

The Germans, Americans and I.C.I. in this country produced powders containing about 70 per cent of available chlorine, but when tested it was found that these powders did not withstand storage in the tropics so well as water-sterilizing powder, so they were not adopted.

Ozone and katadyne silver were also tested as sterilizing agents at the Royal Army Medical College, but ozone required complicated and fragile apparatus and katadyne silver was much slower in its action than chlorine.

Ammonia-chlorine was advocated first in America by Race [6] as a sterilizing agent for water and at the Army School of Hygiene by Harold, Ward and McKibben [7], and Mackenzie [8], also at the Royal Army Medical College, Elliott [9] investigated the matter from a service point of view. Owing to the sterilizing action of the ammonia-chlorine being slower than that of chlorine and the complication required by the addition of a second chemical, the method did not become widely used, except for the large installations.

Mackenzie eventually advocated superchlorination followed by dechlorination [10] which has been suggested by Horrocks [2] and others. This method has the disadvantage that two chemicals are used, but it has the advantage of speed and surety that all pathogenic organisms are killed. The advantages outweigh the disadvantages, so the method was adopted. The method requires the addition of two parts of chlorine above the amount deviated to one million parts of water and after not less than fifteen minutes' contact, a solution of

a number of "Detasting Tablets" is mixed with the water after it has been tested for free chlorine. With water so treated there have been no complaints of taste and, in some cases, the oxidation of the organic matter in the water during the treatment has improved the appearance of the water. Super-chlorination is definitely effective in killing all pathogenic organisms in water, but cercariæ in Egypt and other localities require much more drastic treatment. Sproule recommended [11] the addition of three parts of free chlorine with a contact time of thirty minutes. It should be noted that cercariæ will wriggle through filters.

During the war, the Americans discovered the "break point" process for chlorinating water supplies, but it is too complicated for Field use by only partly trained troops. It involves a complicated test to ascertain the proportion of chlorine remaining after increasing amounts of chlorine have been added to the water. It is claimed that tastes can be avoided and the appearance of the water improved; but on the other hand, larger quantities of chlorine are required than in Mackenzie's superchlorination method.

The Horrocks' box or "Case, Water Testing, Sterilization" still remains the best device for the determination of the chlorine-deviating power of a water. It has been adapted, by the provision of 0.1 gramme sodium thiosulphate tablets, to test the strength of water-sterilizing powder and to determine the proportion of free chlorine in water. It may also be used to determine the "break point" of a water in connexion with chlorination by that process.

It was felt, however, that the Horrocks' box was too cumbersome for inspecting Officers, so during 1947 the Royal Army Medical College considered alternatives and finally decided on a small Lovibond Comparator with a disc showing up to 2 parts of chlorine per million at intervals of one-quarter. The indicator devised, based on an American idea, consisted of a knife point from a small bottle of powder fitted in the comparator consisting of ortho-tolidine and potassium acid sulphate. A powder is more convenient for carriage than the usual solution of ortho-tolidine in hydrochloric acid. In 1948 these outfits were ready for issue to certain Hygiene Officers and to other inspecting bodies. There is one drawback to the use of ortho-tolidine, if the water contains ammonia, the full colour caused by the free chlorine when ammonia is present, is not developed until half an hour has elapsed, whereas with the iodide and starch indicator of the Horrocks' box, both chlorine and ammonia-chlorine develop full colour immediately. The ortho-tolidine keeps better than the iodide solution but, in the latter case, the addition of minute (one drop per pint) amounts of formalin and a little larger (0.5 ml.) amount of N/10 caustic soda solution, enables the indicator to last for years.

The water tank truck and trailer carry and store the water for units under ordinary conditions but, for invasion purposes, where water may not be available, 4½-gallon Jerricans were used and for D-day in June 1944, many thousands of these cans were landed, containing either petrol or water. The idea originated with the Germans in North Africa and we copied them. They were lined (for water carriage) with bitumen paint, thinned down with

trichlorethylene and much time was spent in blowing out the last traces of trichlorethylene to avoid tainting the water. The outsides of the cans were painted in colours different from the petrol cans and had embossed letterings on them to denote the contents.

LARGE-SCALE MOBILE EQUIPMENT

During the 1914-18 war, the water companies were provided with barges and large heavy lorries for the purification of water. Between 1920 and 1930 work was carried out at the Royal Army Medical College to devise a light mobile equipment and an outfit giving about 1,500 gallons of water an hour and weighing less than a ton was devised. Cloth filter presses and alum were used at first for filtration but on succeeding models, metal filters with ten square feet of surface have been provided. For the sterilization of the water, a completely new method was introduced, comprising the addition of a freshly electrolysed solution of salt. The amount of salt added to the water was tasteless (about 10 parts per 100,000) and the amount of chlorine was varied by a resistance, reducing or increasing the electric current through the salt. As the necessary current had only four volts pressure it was perfectly safe, and was generated from a dynamo driven by the pumping engine. After trials had proved successful, the matter was handed over to the Royal Engineers. The trade took up the matter and the Army tested various types, some were satisfactory and others were not. The other Services also adopted some of these plants, but the most successful were the types using electrolytic methods and the present trend is to continue with them. Failures occurred with certain types feeding in a solution of bleaching or water-sterilizing powder owing to blockage of the valves with powder due to careless working by personnel.

Ammonia in the form of a solution of an ammonium salt was fed into the water in these plants, to form ammonia-chlorine. Ammonia chlorine is more persistent than ordinary chlorine, does not taste so much and is barely deviated by organic matter in the water but, as stated previously, is much slower in its action. Under the circumstances it was considered preferable to ordinary chlorine. From the results of experiments made at the Royal Army Medical College and by certain water engineering firms, it has been shown that freshly-made electrolytic chlorine is the most potent water disinfectant we know at present. Eventually electrolytic plants were installed in all H.M. Ships on the advice of Mr. Frederick, Adviser in Hygiene to the Admiralty, with very successful results and recently various shipping companies have been installing them.

LARGE-SCALE STATIC EQUIPMENT

The Royal Engineers have large scale static equipment for Base camps and large bodies of troops on lines of communication. In the case of the smaller (12,000 gallons per hour) types, large metal-kieselguhr filters are used but in the larger types (up to 30,000 gallons an hour), sand filters are used. In all cases, chlorine gas is the sterilizing agent. These units are transportable but not mobile, and they follow classical practice in their operation.

POISONOUS SUBSTANCES IN WATER

Not much work has been carried out in connexion with the poisoning of water supplies, because no nation has yet resorted to this form of warfare.

The Chemical Defence Research Department devised a charcoal filter for removal of certain agents from water and a test at the Royal Army Medical College with dye and bone oil, showed it to be very effective in purifying water, the resulting filtrate having a better appearance than the London water used to make up the mixture! The apparatus comprised an engine and pump with a metal-kieselguhr filter to remove insoluble material and prevent clogging of the charcoal and two six feet tall cylinders two to three feet diameter, lined with bitumen and filled with graded absorbent charcoal. The cylinders could be easily taken to pieces for the removal of the charcoal.

The Germans, during the war, fitted charcoal cylinders to their mobile water purifiers and used an ingenious self-cleaning filter of porous plates. Instead of chlorine they relied on large Zeitz filters for sterilization, but we found that they carried bleaching powder, just in case.

Sporadic experiments were carried out at the Royal Army Medical College on improving methods suggested during the 1914-18 war, for the removal of poisonous metals, etc., from water. In nearly every case the end-result left the laxative chemical, sodium sulphate, in the water, to a degree corresponding to the amount of poison present. The Americans devised very large stills during the war, for converting sea water into potable water and for use during landings on the Pacific Islands. These, of course, could be used for the removal of poisonous metals, but the matter has not yet been considered. In order to remove salt from water, a plan was considered to use in North Africa lorries with cylinders of synthetic resins, but as the scheme involved the use of skilled personnel, hydrochloric acid and soda as regenerating agents for the resins, the matter was not pursued, but it may have to be adopted to remove radio-active isotopes from water in a widespread atomic war. The R.A.S.C. used small synthetic resin plants in the campaign in Italy for the production of distilled water for "topping up" batteries and radiators. Other work was carried out during the war by the Department of Scientific and Industrial Research on silver zeolites and similar substances for the conversion of sea water into fresh water. The Air Ministry used such substances for the collapsible boats in the sea rescue service.

The "case, water-testing poisons" was modified just before 1939 in several ways and the present case was then designed by Major F. Walker to include these modifications. The test for arsenic was changed to the Gutzeit test using the stain on mercuric chloride paper instead of the flame and white tile test. This obviated the extinction of the flame in the open air by wind and the risk of explosion. The iodoplatinate test for mustard gas was incorporated about 1936 and the D.B.3 test for nitrogen mustard in 1944.

The Royal Army Medical College, at the request of the War Office, devised a lighter box during the war, based on a small American box. The reagents were carried and added to the water to be tested, in a solid state, thus saving weight of water carried in the solutions, and corrosion of hinges, etc. The

spirit lamp was replaced by hexamine. The project has not been proceeded with, in view of the introduction of new insecticides and other commercial poisons such as fluoro-acetates, etc., which may require the addition of further test reagents.

TREATMENT OF SULLAGE WATER

Sullage water from cookhouses and ablution rooms had always been a nuisance and its disposal a problem. During the period between the two wars, preliminary work was carried out on this problem at the Army School of Hygiene by Harold and Blackmore with very little success.

Sullage water contains insoluble calcium soaps and grease, which are filtered out by the earth lining of soakage pits and surface channels forming an impermeable lining which stops further soakage into the ground and the pit overflows. This invariably happens in practice and, in the event of a rain storm, the position became intolerable.

The problem was eventually solved by Hattersley [12] at the Army School of Hygiene. He found that the addition of 30 to 40 grains of copperas (ferrous sulphate) per gallon of sullage water followed by sufficient lime to give the mixture a pH value, of 8.5 (pink to phenolphthalein) yielded a clear fluid and a non-putrescible sediment. The former could be disposed of into a stream and the latter scattered on land and dug in. Mackenzie and Hilton-Sergeant [13] developed this pilot-plant and determined the practical details for operating the method. An installation was erected at a standing camp at Wyke Regis in Dorset and the results were so satisfactory that the method has been generally adopted.

The purification of waste water from Mobile Laundries was studied at the Royal Army Medical College in 1939. The two problems were (1) how best to purify the effluent before discharge into a stream, and (2) how to purify the rinse water so that it could be used again in waterless regions.

The first problem was solved by using Hatterley's method as modified by Mackenzie and Hilton-Sergeant, but the laundry people were not at all in favour of using that method for the solution of the second problem on account of the risk of iron mould on the material being washed. It was finally recommended that the wash water should be wasted and run into a stream after purification with copperas and lime as it was liable to be coloured by dyes from blankets, etc., and the rinse water purified by sedimentation with alum and filtration through a metal kieselguhr filter before being used again. If the wash water were not coloured, it could be added to the rinse water and used again after purification by sedimentation and filtration. The resulting water was clear, softened and suitable for washing but it was quite im potable on account of the taste of the citronella and other essential oils in the soap used.

ADMINISTRATION AND TEACHING

During the period under review, the Royal Engineers have been responsible for the provision and purification of water supplies and the Royal Army Medical Corps have been responsible for advising them as to methods of treatment and for testing the supplies. In the purification on the large scale, the Royal Engineers have devised and erected the plant ; on the mobile lorry

scale, the R.A.M.C. and R.E. have collaborated, and on the unit and individual scale, the R.A.M.C. alone have dealt with the matter. Other branches have also arranged purification methods on their own; for example, the R.A.S.C. devised their own method in 1937 for the purification of water supplies for Field bakeries.

It was felt by all concerned, that after the 1939-45 war, all the branches interested should be brought together and so, in January 1947, the first meeting of the Inter-Services Advisory Panel on the Purification of Water Supplies in the Field, was held under the Chairmanship of Brigadier A. E. Richmond, Director of Hygiene.

With regard to teaching, the courses at the Royal Army Medical College have taught both hygiene specialists and all other officers of the R.A.M.C. about the details of water purification. There were held, during the war, special courses for R.A.S.C. officers in this subject, and also Officers Commanding Mobile Hygiene Laboratories were trained in water purification and the chemical and bacteriological analysis of water.

The Army School of Hygiene taught many thousands of combatant officers and other ranks about the purification of water, with the result that the efficiency of the water duty men was very greatly increased.

In spite of all the work which has been done, there is yet much to be learned about the purification of water and the advent of atomic and biological warfare will create new problems which will have to be solved. There is also the possibility that new and better sterilizing agents may be discovered together with greatly improved equipment.

It has not been possible to consider every aspect of the subject in detail and keep this article to a reasonable size; moreover, much of the work has not been published but is in the form of reports to the War Office so reference to the originals is difficult. In the event of difficulty in tracing an original article, it is suggested that the Inter-Services Advisory Panel, whose Secretary is at the War Office, would be pleased to hear about it and to help in the matter.

I have to thank the Professor of Hygiene, Royal Army Medical College, and the Commandant, Royal Army Medical College, for permission to publish this paper.

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THE ACUTE ABDOMEN IN MILITARY SURGICAL PRACTICE

A Clinical Study of 430 Consecutive Cases of Acute Abdominal Disease Submitted to Operation in the General Surgical Unit of the Cambridge and Louise Margaret Military Hospitals During the Twenty-month Period October 15, 1946, to August 14, 1948

BY

Lieutenant-Colonel D. C. McC. ETTLES

Royal Army Medical Corps

Officer i/c Surgical Division During the Period under Review

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THIS paper is presented as a clinical analysis rather than as a scientific article. It records a consecutive series of 430 cases and demonstrates one aspect of the work carried out in military practice in Peace. The series is not in any way a personal one although I was, naturally, concerned with the diagnosis and treatment of a large number of them. The operations were performed by a number of Surgeons whose names appear in the text. Some have now been released from Army Service.

Most cases have been young soldiers but the extremes of age varied from 2 days to 50 years. The overall mortality was 2. The first, a case of imperforate anus, died on the third day of life following left-sided colostomy. The second, a case of appendicular abscess, is referred to later. Twenty-two of the cases occurred in families personnel and operation was performed by the general surgeons of the Cambridge in the Louise Margaret Hospital. No gynæcological emergencies have been included in the series with the exception of two A.T.S. personnel suspected to be suffering from appendicitis but proved to be hæmorrhages into ovarian cysts.

The 430 cases are classified as follows :

Acute appendicitis	364 (1 death)
Perforated peptic ulcer	14
Acute intestinal obstruction	11
Regional ileitis	3
Strangulated hernia	3
Intussusception	2
Bleeding peptic ulcer	2
Hæmorrhage into ovarian cyst	2
Subphrenic abscess	2
Rupture bladder	2
Internal hæmorrhage	4
Torsion of omentum	1
Imperforate anus	1 (died)
Acute pancreatitis	1
Perforating wound stomach	1
Lymphangiomas	1
No lesion demonstrable at operation	16 Total 430

The appendicitis series is further analysed.

Disease localized to the appendix	304
with local peritonitis	33
with abscess formation.. .. .	15 (1 died)
with diffuse peritonitis.. .. .	12

COMMENTS ON THE APPENDICITIS SERIES

The History, Signs and Symptoms.—A tentative diagnosis of acute gastritis should always be received with caution. Apart from alcoholism and some forms of poisoning, it is doubtful if acute gastritis is a clinical entity. It is more doubtful still as a differential diagnosis in acute appendicitis. Repeated vomiting and nausea rather than pain should be its main features. Too often this diagnosis cloaks failure to obtain an accurate history or make an adequate examination.

A young soldier whose intermittent pain, at first central, moves after a few hours to a fixed point in the right iliac fossa is suffering, almost invariably, from acute appendicitis and the case should be regarded as such until proved otherwise. Vomiting is variable, but nausea is common. Pyrexia is frequent but by no means invariable. Repeatedly, one is told that a case is not one of appendicitis because there is no rise in temperature or pulse, yet it is a common experience of all surgeons to remove the gangrenous appendix, often obstructive in type, from a patient whose temperature is 98.4 and pulse 70. A dry furred tongue is practically always present and is of real significance. Many cases have a characteristically sweetish smell in the breath which is a reliable indication of the urgent need for operation.

It should be unnecessary to mention the dangers of purgation, but the rule to avoid such purgation cannot be overstressed. The bursting of the obstructed appendix following such ill-advised treatment is frequently excused by the indifferent clinician on the grounds that purgatives have relieved many more cases of intestinal colic than have been hurtful in appendicitis cases. Purgation is a highly dangerous form of interference which cannot be condoned on any grounds.

The Operation.—A gridiron incision is almost routine. It can be immediately converted into a Rutherford Morrison muscle-cutting incision, should difficulty arise in delivery of the appendix and no harm results provided the divided muscles are approximated by suture on completion of the operation.

The decision to drain can never be reduced to a simple formula but it is frequently a wise precaution. It is more often advisable to drain the abdominal wall. Hamilton Bailey's "Emergency Surgery" states that drainage is unnecessary in unperforated appendicitis, however evil the organ may look, but this rule should not be regarded as a hard and fast one.

A fit, middle-aged officer with a straightforward history had a paracæcal, gangrenous, but unperforated appendix removed and it appeared safe to drain the superficial wound only. His condition soon gave rise to anxiety with pyrexia, right basal pain and later, frank lobar pneumonia. He improved only when the wound started to discharge. A faecal fistula developed which

had to be closed intraperitoneally ten weeks later. The whole illness lasted four months and was presumably largely avoidable had the peritoneal cavity been drained.

The Post-operative Conduct of the Case.—There is a tendency to abandon the use of the Fowler position. This is not the place to go into the arguments for and against this time-honoured procedure, but there is no doubt that it is frequently unnecessary. If the patient can lie down comfortably, or turn on his side to sleep, post-operative progress may be more smooth and convalescence more rapid. The strain of the Fowler position has been well likened to the difficulty and discomfort of trying to sleep in an ordinary compartment on a night train journey. With gentle propping, knee pillows can be avoided, and this fruitful source of calf thrombosis obviated. Breathing exercises are instituted as early as possible and the patient encouraged to lift himself up in bed as soon as he is able. It is far better for the patient to go to the annexe in a wheel chair, supporting the wound with a hand over the dressing, than go through the gymnastic feats inseparable from the use of the *bédpan*. Early ambulation is encouraged.

The only grave complication in the series has been paralytic ileus. It is equally important to anticipate this complication whenever it is considered likely to ensue and institute treatment accordingly by continuous gastric suction and intravenous fluids. When syphonage suction does not work well, intermittent hourly emptying by syringe is equally effective. Should a suitable vein be available, insertion of the needle so that the forearm lies semiflexed in the mid-prone position adds greatly to post-operative comfort. This regime is continued up to seven days if necessary but can generally be terminated in thirty-six to seventy-two hours. If the drip is interrupted by accident or design, suction must be stopped otherwise rapid dehydration will ensue. Sedatives in the form of *alupon* are given as required. Radiant heat to the abdomen may be most helpful and comforting in severe cases. A small enema is given when bowel sounds have returned. Purgatives are forbidden. The treatment of ileus on these lines has been most gratifying in every case.

If toxæmia is severe, or peritonitis present, penicillin in 100,000 unit doses given eight-hourly at 0600, 1400 and 2200 hours, up to a million units, allows an eight-hour period of unbroken sleep. Sulphathiazole up to 25 grammes is frequently given simultaneously.

MECKEL'S DIVERTICULUM

There has been no case of primary diverticulitis, but one has been found on four occasions in three of which the presence of the diverticulum complicated the picture. In the first case, a perforated appendix was adherent to a diverticulum which formed part of the wall of an abscess cavity and had caused a partial volvulus of the ileus. The diverticulum was separated and removed. In the second, the tip of an inflamed appendix was connected to a fleshy solid "tumour" dependent from a diverticulum. The "tumour" after removal was reported to be an encapsulated mass of fibrous tissue. The diverticulum was removed. (*Captain T. Menzies.*)

In the third, the diverticulum, found to be attached to the ileal mesentery, was separated and removed. In a fourth case, a wide sessile process was found coincidentally with appendicitis, and was not interfered with.

CASE HISTORIES

Some of the more interesting problems of the series are given in the form of short case histories.

A young soldier of a few days' service was admitted from the isolation hospital where he had been under observation for three days as a possible case of typhoid fever, and a perforated gangrenous appendix was removed. He was so ill that the wound was left unsutured except for the peritoneum which was closed round a drainage tube. For four weeks he remained desperately ill, twelve pints of blood being required to sustain him. Ileus was followed by subcutaneous abscesses over the trochanters and sacrum which had to be drained. A pelvic abscess was followed by a faecal fistula and jaundice, and by this time he was grossly emaciated. However, he gradually turned the corner to make a full recovery. The fistula was closed extraperitoneally. (*Major H. Hall.*)

A private soldier stated that he had undergone no less than five previous operations for appendicitis. At operation, a gangrenous retrocaecal appendix was removed. (*Captain J. Duncan.*) One almost exactly similar case is included in the series.

In one case the tip of the appendix could not be delivered and was found to be wrapped up in omentum which passed upwards and inwards through a congenital defect in the ileal mesentery. The tip, which was adherent to the mesenteric vessels on the far side of the defect, was detached with difficulty and the gap closed. Post-operative ileus was followed by a short attack of diarrhoea which settled after a few days.

A soldier had been treated in the medical division for three days. On transfer to the surgical side, he was considered to be a case of peritonitis complicating appendicitis and treated on Oschner-Sherren lines. Five days later, a large appendicular pelvic abscess was opened, and two pints of pus sucked out. He never showed really satisfactory evidence of overcoming his infection. Toxaemia was followed by bronchopneumonia, and in spite of every effort to rally him by transfusion his condition gradually deteriorated. On the tenth day after operation he developed severe melæna and died the next day. At autopsy, there was severe plastic peritonitis with pockets of foul pus in the pelvis, mesentery, and under the diaphragm. The appendix was free but gangrenous and the ileum partly gangrenous. There was a perforation of the first part of the duodenum, presumably terminal, and a patchy bronchopneumonia. (*Major H. Hanley.*)

Two other cases of appendicular disease, not included in the series as they were not emergencies, were of interest.

A Sapper, a middle-aged obese man, giving no history of any attack resembling appendicitis had a palpable tumour in the right iliac fossa. The history was indefinite, the investigations inconclusive and laparotomy was

performed with carcinoma of the cæcum as the likely diagnosis. A very adherent mass was found involving the cæcum, which, while it was being assessed, burst, disclosing an appendicular abscess which was drained. The appendix was removed six weeks later. (*Major E. Skinner.*)

A Corporal, who was admitted to the Connaught Hospital from overseas with a diagnosis of tuberculous mesenteric adenitis, had a palpable tumour in the right iliac fossa which was tender and pitted slightly on pressure. The possibility of appendicitis was considered. An incision over the centre of the mass opened an abscess cavity which involved the muscles of the anterior abdominal wall with the distal half of the appendix lying in it. Appendicectomy with removal of the abscess cavity was comparatively simple.

PERFORATED PEPTIC ULCER (Fourteen Cases)

None of these cases was treated conservatively although it was clear at operation that at least four of them would have sealed off safely without operative interference. All were submitted to operation. One, a Guardsman, had been perforated for five days; another, an elderly Naafi employee of "50" years, for forty-eight hours, whose clinical note on admission to the hospital was "acute gastritis—treat for stomach." All fourteen cases did well.

ACUTE INTESTINAL OBSTRUCTION (Eleven Cases)

The causative factor in six was a previous operation for appendicitis, and the surgery required took the form of adhesion section. One previously operated had had an entero-anastomosis performed. Another showed a volvulus of the upper three feet of the jejunum from a strong band.

An Officer aged 48 was admitted with acute intestinal obstruction. Laparotomy disclosed an internal hernia into the pelvic mesocolon. The trapped coil was easily withdrawn and the defect closed. (*Major H. Hall.*)

A woman had had repeated obstructive attacks with central abdominal pain, vomiting, distension and visible peristalsis, dating from the replacement of a coil of intestine presented at the vulva following an induced abortion performed overseas. Eight laparotomies had been performed and at the ninth occasion a determined effort was made to sort out the adherent coils. As so often happens this was only of temporary value, and the peritoneal cavity has now become large obliterated. It has never been found possible to pass a Miller-Abbott tube successfully. However, she overcomes these attacks in a remarkable way and, as there is some evidence that the attacks are precipitated by premenstrual congestion, and as she has children, it has been decided to induce an artificial menopause by irradiation.

A Private aged 19 was admitted with acute obstruction. Laparotomy showed adhesion and kinking of the ileum by a burst tuberculous gland abscess in the mesentery. The abscess was mopped out and the gland removed. No further treatment was necessary to relieve the obstruction. There has been a second almost identical case. Both did well but convalescence was prolonged in the first by plasma jaundice.

During the past twenty months, five surgical cases have developed jaundice

as a complication of plasma therapy. Fortunately they have all made a full recovery but jaundice has persisted for three months. The date of onset of the jaundice has been the same in all five cases, almost exactly ten weeks from the giving of the intravenous plasma. This complication made it necessary to issue a hospital instruction to the effect that, with the exception of severe burns or grave emergency, plasma should only be used after consultation with the officer i/c transfusion.

REGIONAL ILEITIS (CROHN'S DISEASE) (Three Cases)

A Boy aged 15 was admitted for renal investigation and three minute calculi were seen on cystoscopy. Three days after discharge he was readmitted with acute abdominal symptoms. At operation, the appendix was normal but the cæcum and terminal six inches of the ileum were red, thickened and velvety in appearance. Numerous fleshy mesenteric glands were enlarged. Three surgeons present considered the appearance to be strongly suggestive of Crohn's disease but, as there was no evidence of stenosis or advanced change, no anastomosis or resection was performed. A second almost identical case occurred and again, for the same reasons, no resection or anastomosis performed. Both cases made a full recovery but will be kept under observation. Unfortunately, histological proof is lacking in both. Both were operated on as cases of subacute appendicitis.

A Private aged 19 gave a three months' history of central abdominal pain and constipation, but no vomiting. A week prior to admission the pain had become worse. On examination, there was a large palpable mass in the right side of the abdomen level with the umbilicus but not extending into the loin. T. 99.2. P. 90. He was under investigation when his symptoms became acute and at laparotomy the mass was found to consist of grossly enlarged mesenteric glands in the centre of which was a breaking-down abscess cavity. The right colon and cæcum were involved in the inflammatory process and immediate right hemicolectomy was performed. The macroscopic and histological changes were those of Crohn's disease. He did well. (*Major M. Bennett-Jones*—one of two cases reported in the *British Journal of Surgery*, July 1948.)

STRANGULATED HERNIA (Three Cases)

Two were inguinal, one umbilical. One of the inguinal cases was in a Polish soldier who had undergone an operation for radical cure in a Polish Hospital two months previously. Six inches of viable intestine were found tightly packed into a scrotal sac which showed no evidence of previous operative interference. Radical cure was performed.

INTUSSUSCEPTION (Two Cases)

The first was a straightforward infantile case. The second, a Private, aged 18, was admitted with abdominal colic and vomiting for thirty-six hours. Nothing had passed *per rectum* for seventy-two hours. Tenderness, with an indefinite mass, was found in the right iliac fossa. Laparotomy disclosed an ileo-colic intussusception, the apex of which had reached the hepatic flexure

from its starting point two feet above the ileo-cæcal valve. On reduction, 3 in. of the ileum looked black and of doubtful viability. Nine inches were resected and a side-to-side anastomosis performed. No cause could be found in spite of careful search. He did well. (*Major H. M. Goldberg.*)

BLEEDING PEPTIC ULCER (Two Cases)

Both these cases were operated on as emergencies.

A Serjeant aged 33 had been under treatment for ulcer for ten weeks in another hospital. He was transferred to the Cambridge for further treatment but developed severe hæmatemesis and melæna. Blood transfusion failed to control the hæmorrhage, his pulse started to rise steadily, and it was decided to operate. Laparotomy showed a large anterior duodenal ulcer which was excised with transverse suture of the duodenal wall. The right gastric leash was tied in continuity. He did well. (*D. E. and Major F. F. Rundle.*)

A Private aged 19 was also under treatment as an in-patient when he developed severe and uncontrollable hæmatemeses, and, as in the first case, it became apparent that the bleeding was continuing. Laparotomy showed a very large ulcer crater, close to the pylorus, to be eroding the pancreas. Gastrotomy was performed and an attempt made to obliterate the ulcer by five deep sutures from within. These controlled the bleeding but ten days later it recommenced. Partial gastrectomy was successfully performed under full blood cover. (*D. E. and Major H. Hall.*)

SUBPHRENIC ABSCESS

Rather surprisingly, there were only two cases. The first, an anterior abscess, complicated partial gastrectomy for chronic peptic ulcer. This case also developed a pelvic abscess, but subsequently made a good recovery. The second occurred as a complication of an infected hydatid cyst of the liver. The patient, an N.C.O., had been sent home from overseas following laparotomy for spontaneous intraperitoneal rupture. He developed a subhepatic abscess which was drained and found to contain a mass of dead cysts. He did well for a few weeks and then rapidly developed signs of a subphrenic abscess which was drained posteriorly after resection of part of the eleventh rib. He made a good recovery after a stormy convalescence and went to Switzerland under the auspices of the Swiss Red Cross. His anterior and posterior sinuses healed and he is back at duty in a low category, but his future is unpredictable. (*Major M. Bennett-Jones.*)

RUPTURE OF THE BLADDER (Two Cases)

Both cases complicated fracture of the pelvis. The first resulted from a fall from a window thirty feet from the ground. An extraperitoneal tear was successfully sutured. (*Captain F. Robinson.*)

The second showed gross fracturing of the pubic rami with inward displacement of a very large fragment of bone. He made a good recovery after suture of a large bladder tear with suprapubic drainage. (*Captain Ian MacNab.*)

INTERNAL HÆMORRHAGE (Four Cases)

A Cadet was admitted with severe abdominal pain and left-sided rigidity of a few hours' duration. The pain steadily increased in severity, and laparotomy was performed. A large quantity of heavily blood-stained fluid was sucked out but, in spite of careful search, no causative lesion could be found. There were petechial hæmorrhages in the pelvic mesocolon and the only reasonable explanation seemed to be a volvulus of the colon which had undergone spontaneous reduction. All subsequent laboratory and clinical tests were negative. (*Major M. Bennett-Jones.*)

A Private aged 19, a passenger in a lorry accident, was admitted in a state of shock with hæmaturia. Pain, vomiting, left-sided abdominal rigidity and tenderness were progressive. In view of the hæmaturia, it was decided to explore the loin first but only a small amount of perinephric blood clot was found. There was no gross tear of the renal cortex. This incision was closed and a left paramedian incision made. Hæmoperitoneum was present with rupture of an enlarged, adherent spleen which was removed. The pathologist reported evidence of past disease as shown by a moderate degree of "sugar coating" of the surface, but the cause of this was never substantiated. Full recovery. (*Major M. Bennett-Jones.*)

A Cadet was admitted in severe shock following a motor-cycle accident. After resuscitation, laparotomy showed gross hæmoperitoneum with the spleen torn in half. Splenectomy was followed by full recovery. (*Major R. Lawrie.*)

PERFORATING WOUND OF THE STOMACH

An N.C.O. stated that he was playing about with a large clasp knife when he slipped and sustained a perforating wound of the abdomen. The circumstances of the wound were never very clear. The peritoneal cavity was full of exudate, blood and stomach contents. There was a stab wound high up on the lesser curvature of the stomach. Suture was followed by full recovery. (*Captain I. MacNab.*)

ACUTE PANCREATITIS

A Private aged 19 was admitted with severe upper abdominal pain and vomiting. There was a history of operation on the gall-bladder at the age of 6 weeks, stated to have been performed at Great Ormond Street, but his name could not be traced in the records of that hospital. Laparotomy showed an effusion into the lesser sac with fat necrosis and acute hæmorrhagic pancreatitis. The gall-bladder was surrounded by dense adhesions. He made a full recovery following the provision of drainage down to the pancreas. (*Major H. M. Goldberg.*)

TORSION OF THE OMENTUM

A Corporal was admitted with the signs and symptoms of an appendicular abscess and a firm diagnosis made. At operation the palpable mass was found to consist of twisted black omentum which was excised. (*Captain F. Robinson.*)

LYMPHANGEIOMATOSIS OF THE ILEUM

Captain I. MacNab is recording this very remarkable case elsewhere. On a diagnosis of acute appendicitis, operation disclosed two feet of the ileum involved in the disease process, and short circuit, with exteriorization of the affected gut, was performed. Ten days later, the mass was excised by diathermy. Four weeks later, the resulting fistulæ were closed extraperitoneally.

OPERATION WITHOUT DEMONSTRABLE LESION

In fourteen cases, the diagnosis of appendicitis was made but operation failed to discover any disease process. Another was opened for a presumed perforation. All these cases had their appendices removed and their pain relieved. The basis for such relief is probably due to a temporary ileus following pneumoperitoneum combined with sufficient handling of the gut to terminate a simple colic.

The last case, an infant, showed anomalous signs and symptoms of intussusception. Bloody "apple jelly" was produced on the finger tip on rectal examination. At laparotomy through a rectus split incision no lesion was found.

The anæsthesia in the series was undertaken largely by Lt.-Col. W. H. Scriven, *M.B.E.*, then Adviser in Anæsthesia to the Army, Major K. F. Stephens and Captain J. K. Sugden. The absence of serious chest complications testifies to their skill, and I am grateful to them for their help in the post-operative management of the cases, especially in respect of intravenous therapy.

CONCLUSION

This series of 430 consecutive cases of acute abdominal disease submitted to operation has been presented as a record of one aspect of the surgery carried out in a large military hospital in peacetime over a twenty-month period. It is gratifying to be able to record so low a mortality, two deaths in 430 cases. Certain of the cases are described in some detail and observations made on the clinical aspects of certain of the subgroups.

I am grateful to Colonel J. Crawford, Commanding Cambridge Military Hospital and to Lt.-Col. G. Anderton, *O.B.E.*, Commanding Louise Margaret Military Hospital, for their permission to write about these cases, and to Brigadier D. Fettes, *O.B.E.*, Director of Surgery, for his help and encouragement in preparing this paper.

DISPOSAL OF THE SICK AND WOUNDED OF THE ENGLISH ARMY DURING THE SIXTEENTH CENTURY

BY

DAVID STEWART

IN the sixteenth century important changes were made in the methods of disposing of the sick and wounded of the English Army. In earlier times there had been no machinery for dealing with men when they became casualties, and it was not considered that the authorities had any responsibility for their welfare or for assisting in their recovery. If it was thought that incapacitated men would not be ready for service again within a short period, it was the custom to discharge them, and the Army lost all interest in them. If they were fit to travel they made their own way home, if not, they were left to the care of the civil population of the neighbourhood ; and there they either recovered or died.

This system was bad enough during wars within the boundaries of the island of Britain, but in continental wars it must have inflicted indescribable hardships upon the sick or wounded soldiers. What must have been the feelings of these poor fellows, shanghaied somewhere in France among an alien people, speaking an unknown language, and openly hostile to them ? They were not only far from their home, but they were separated from it by a very formidable obstacle, the sea.

Occasionally, however, the authorities realized the hardships that the men underwent under such a system. Edward III, in 1346, evacuated a large number of his sick and wounded to England (Oman, p. 132) ; and the same thing was done in 1415, after the capture of Harfleur, when the numerous victims of dysentery were allowed to return home (J.A.H.R.S., p. 168). This, however, was the only modification made in the normal routine : after the men had landed at the home ports, the authorities were finished with them, the Government felt that it was under no further obligation to them, and they had to make their own way to their homes as best they could.

It has frequently been asserted that the seriously wounded were disposed of in an even simpler manner, in a way that would cause neither trouble nor expense to the higher command ; that is to say, their throats were cut. It has been stated that the dagger called the *misericorde* was so named because it was used for putting the wounded out of their misery. Scott (i, p. 184), however, suggests that this may be incorrect, and that the *misericorde* got its name from the cries for quarter from a wounded man when he saw his enemy advancing with this weapon in hand, ready to finish him off. There may have been isolated instances of commanders ordering the slaughter of their wounded, but these must have been extremely rare. That it was the usual practice, even in the Middle Ages, is more than improbable. It is not even a custom among the wildest and most primitive peoples ; they may slaughter their

wounded enemies—after all Henry V did this at Agincourt—but they take the greatest care to see that their own wounded do not fall into the hands of their opponents, and even in defeat make every effort to carry away their incapacitated comrades.

If the matter be considered seriously, it must be realized that the morale of no Army would have stood up to such treatment. Life means a great deal to any man, and if a soldier knew that the result of being more than slightly wounded would mean that his throat would be cut, then he would take every precaution to see that he was not wounded, and this would have seriously diminished his value as a soldier. It is true that, at this period, the chances of a man recovering from a serious wound were not good, the percentage of deaths under surgical treatment was very high ; nevertheless some did recover ; and as life is sweet, the average man, when he was wounded, must have hoped that he would be one of the lucky ones. Actually, we know that some care was taken of the wounded during an engagement. At the Battle of Poitiers, at one stage of the fight, the French made a vigorous attack and nearly won the day, because they caught the English busily employed in getting their wounded out of the fighting line to the rear (Oman, p. 173).

In the first part of the sixteenth century little improvement was made in the methods of disposing of the sick and wounded. Of the earlier, and rather farcical, wars of the reign of Henry VIII there is little or no information, but in the campaign of 1544 the wounded were dumped in England much in the same way as had been done during the reign of Henry V. There was, however, one important difference : an attempt was made to prevent fit men from getting away on the excuse of being sick (S.P.H., viii, p. 114). This does not appear to have been very successful as there were bitter complaints from the Privy Council to the Duke of Norfolk, that large numbers of men, perfectly fit for service, were being shipped over to England. The King went so far as to accuse Norfolk of doing this deliberately, so as to render his force unfit for further service, and thereby to make it necessary to recall him (L.P.H., viii, p. 224).

Norfolk and his colleagues repudiated this charge most strenuously (*ibid.*, p. 235), but there is evidence to suggest that Henry's suspicions were not ill-founded. After the failure of the siege of Montreuil, Norfolk had retired to Calais, and continued to stay there, although he was urged from home to march to the relief of Boulogne, which at that time was besieged by the Dauphin. It was while the troops were at Calais that the immense exodus of the sick and others took place. One cannot blame the unfortunate troops, there had been a severe outbreak of dysentery, soldiers were literally dying in the streets, and naturally the men took the first opportunity of escaping from these horrors. Norfolk realized all this, and felt that something had to be done to check the wastage ; he therefore appointed a small committee consisting of Sir George Carowe, and Messrs. Baynton, Harper, and Ryche to superintend the evacuation, and to see that none but the truly sick were allowed to depart for England (*ibid.*, p. 235). These gentlemen were not medical men, and it is difficult to see how they could have been expected to carry out their difficult

task efficiently; indeed, Norfolk acknowledges that they did not do so, and that a number of malingerers slipped through their hands to get away to England. The whole business seems rather dubious,* and one wonders if the committee were really expected by the commander-in-chief to do their work efficiently, or were merely appointed as a blind, in order that Norfolk could pretend that he had taken all possible steps to prevent fit men from deserting the colours, at the same time putting no real obstacles in their path. In this way he hoped that his Army might be so diminished in numbers that his recall would become imperative. However, whatever may have been the reasons for the formation of this committee, for the first time a body was set up to control and direct the evacuation of the sick and wounded, and this in itself was a marked improvement on what had happened before. But nothing appears to have been done for the sick when they arrived in England, presumably, as in the past, they made their own way home, and the Government felt that it had no further responsibility for them.

Incidentally, it must be noted that the French managed to capture one of the ships carrying some of the sick men, and this will not be the last time that we shall have to record such an action by the ancient enemy.

During the dreadful siege of Havre in 1563, many of the sick from the plague-stricken garrison were discharged, and sent over to England. Towards the end of the siege things were arranged more systematically than at the beginning. Sir Francis Knollys was sent over to the town to inform the G.O.C. that he could discharge all the men who were undoubtedly sick, or who were so seriously wounded that they would not recover within a short period. So that their discharge might not be held up from a shortage of money—with which to pay them, they were given tickets signed by the local treasurer and controller, and they would be given their pay on presenting these on their return to England (C.S.P.F., 1563, p. 401). This again was an improvement on what had happened in the past.

When the garrison was allowed to return to England after the surrender of the town, the sick and wounded were carefully looked after at the port of disembarkation. The last detachment arrived at Portsmouth on August 6, 1563, and here the troops were mustered and discharged, except for the sick, who were retained until their condition had improved sufficiently to allow of their being sent to their homes (Salisbury, i, p. 277). They were accommodated in Porchester Castle, and some of them were still there on September 8, but their numbers were now decreasing daily (*ibid.*, p. 282). It is interesting to observe that history repeated itself ninety years later, and in 1658 a proposal was made to use Porchester Castle to house naval casualties (C.S.P.F., 1652–3, pp. 235–6).

During the wars in the Low Countries, the methods employed for disposing of casualties shows little improvement over those in force in previous wars. Sir John Smith complains that the sick soldiers, who were brought to England in 1584, were in a disgraceful condition, and many of them died after their arrival in this country (Scott, ii, pp. 368–9). Three years later there were complaints from Flushing of the miserable state of the sick in that town.

Men had been discharged from the Army, and sent there to await shipping for England, without any money. If it had not been for the charity of the governor who, at his own expense, supplied them with food and drink, large numbers of them must have perished (C.S.P.F., 1587, p. 368). A year later, in 1588, things were no better, and on this occasion the situation was only saved by a collection in the local church. It was recommended that captains should not be allowed to discharge sick men from their companies, nor stop their pay, until shipping was available to take them to England (C.S.P.F., July–December 1588, p. 345). From what we know of them there cannot be the slightest doubt that the captains of that period would take the first opportunity of getting rid of the sick of their companies, as by doing this, they would be able to put money into their own pockets. They would discharge the sick men, but would continue to show their names on the company rolls, and would draw the pay of the absentees for their own benefit.

Possibly on account of these complaints, the Privy Council began to take an interest in the disposal of the sick and wounded. In 1589 an English Army had been sent to France under the command of Lord Willoughby to assist King Henry IV. However, by the end of the year it became very sickly and the French King agreed to its being returned to England. The Privy Council took a hand in the evacuation, and sent Captain Ward over to Cherbourg in command of two of Her Majesty's ships to superintend this operation. They gave him orders to hire a sufficient tonnage of merchant shipping to accommodate the bulk of the troops, while the remainder were to be brought back in the two royal vessels. He was particularly warned to see that the sick were placed in the hired transports, and that he should put no man suffering from infectious disease aboard the two ships of the Royal Navy, lest they might contaminate these vessels (A.P.C., 1589–90, p. 303). At the same time they arranged to send money over to France to enable Willoughby to issue a portion of their pay to his men (*ibid.*, pp. 291–2). Although the Privy Council appears to have been less interested in the welfare of the sick than in the cleanliness of Her Majesty's ships, they at least did make arrangements for the soldiers to have some money, and, as we shall see later, they made preparations for the reception of the sick and wounded on their arrival in this country.

The schemes of the Privy Council, however, went astray, because Willoughby had already made his own plans, and had begun to evacuate the sick and wounded to Rye before he received the instructions of the Privy Council. As soon as that body received this information, they issued orders to the Mayor of Rye to take charge of the sick when they arrived; to see that they were properly looked after; to pay each of them ten shillings; to get them billets; to arrange for their rations; and, when they should be fit to travel, to issue passes to them to enable them to get to their homes (*ibid.*, pp. 308–9).

These instructions were faithfully fulfilled by the Mayor of Rye. Some 80 odd sick soldiers were sent to that town and judging by his report, the local authorities dealt with the situation very competently:

The Mayor and Jurats of Rye to Sir Francis Walsingham. Rye, Feb. 5, 1590.

"The diseased soldiers . . . rested upon the town's charge eight days in most miserable

sort, full of infirmities in their bodies, wonderfully sick and weak, some wounded, some their toes and feet rotting off and lame, the skin and flesh of their feet torn away with continual marching, all of them without money, without apparel to cover their nakedness, all of them full of vermin, which (no doubt) would have devoured them in very short time if we had not given them most speedy supply. Whereby we were constrained to wash their bodies in sweet waters, to take from them all their clothes and strip them into new apparel, both shirts, petticoats, jerkins, breecks and hose, made of purpose for them. Then we appointed them several houses for their diet, and keepers to watch and attend them, and also surgeons to cure their wounds and rottenness; by this means we have saved some forty-eight of them which will be able to do Her Majesty good service . . . And this has been to the town of Rye so great a burden as we are not able to bear. And that now happeneth amongst us is much to our grief (God of his mercy stay in his good time), for the persons in whose houses they were lodged and dieted, and the women that did attend and watch them are for the most part fallen very sick, and every day there dieth four or five of them with the infection which they had from the soldiers.

"We therefor humbly pray that the burden of this great charge, performed from charity and duty to God and Her Majesty, may not lie upon us, which charge, as appears by the book herewith sent, amounts to the sum of £55 : 11s. : 3d. ; besides the charge of the soldiers that remain in Rye, which will be above 50s. every day." (Ancaster p. 305.)

This letter from the Mayor of Rye and his colleagues has been given in full, because it gives such a vivid picture of the means available at that time for caring for the sick and wounded, and of the risks which a town ran when infected soldiers were placed in its midst. One feels that it will be generally agreed that the authorities of the town of Rye carried out their difficult task in a most admirable manner. The steps, which they took to cleanse the men and issue them with fresh clothing, were the best available at that period for the prevention of the spread of the disease (presumably typhus) to the civil population. It can only be regretted that they were unsuccessful in achieving this objective; and it is to be hoped that they were duly recompensed by the Government for their expense and trouble. But, judging by the experience of other towns at a later date, it is probable that they had to wait a long time for their money.

During the campaign in France in 1591, a further improvement was made in the methods of evacuating the sick and wounded from the Continent to England. The responsibility for supervising this work was put into the hands of a special officer, Sir Henry Killigrew, who was posted to Dieppe for this purpose. He found his task a difficult one, and as early as September 22 he is complaining of the difficulty of preventing men from slipping off to England on their account. He maintains that there is no excuse for this conduct, as everything possible is done for their welfare at Dieppe (Salisbury, iv, p. 127). The evacuation of the sick was quite a large undertaking, and by the end of October some 1,700 of them had been shipped back to the home country (*ibid.*, p. 155). About this period there was a hold-up in the evacuation on account of contrary winds, and some of the men on board the transports were suffering from a shortage of rations and money. The former shortage was due to the fact that the governor of the town was a Frenchman, who could not issue rations to English troops without orders from his superior officers, and

Killigrew promptly wrote to the Earl of Essex asking for such orders to be issued. Killigrew considered that the shortage of money could be due only to one of two causes. Either the company commanders had never issued it to the men, or, as he thought was more probable, the men had had it and spent it before they arrived at Dieppe (*ibid.*, pp. 157-8). From what we know of the captains of those days, it is probable that Killigrew was wrong in his suggestion, and it is more than likely that the company commanders had not issued any pay to these invalids, and as soon as they had got rid of them, had pocketed the money themselves.

Killigrew throws an interesting sidelight on the methods of financing these evacuations, when he mentions that he has had to go to the expense of hiring a ship himself to take the last batch of 200 invalids. He asked, on the ruling of the Lord Treasurer, that this money may be refunded to him by the company commanders; in other words, from the pay of the men themselves. At this time, and for the next two hundred years, the financial authorities acted on the principle that all the expenses of the soldier should be met from his pay. It was from this doctrine that the evil system of stoppages came into existence.

The fact that the sick were short of money evidently came to the notice of the Privy Council, for that august body issued an order to the effect, that if it seemed likely that a sick man would be ill for a lengthy period, he was to be paid up to date by his company, and sent home with a special pass showing which part of the country he came from, and to which Company in the Army he belonged (A.P.C., 1592, p. 101). The Privy Council knew their company commanders better than Killigrew did, and realized that the cause of the shortage of money was due to neglect by the men's captains.

Although the machinery of evacuation was primitive and moved with difficulty, nevertheless it moved, and a distinct advance had been made in the transportation of sick from the Continent; and the Government realized that they had a responsibility for the sick, and that it was its duty to get them home to England. On this side of the water improvements had also been made. It was not now thought to be sufficient to pay a man up, and to tell him that he was free to make his own way home, without considering whether he was fit to do so or not. Now before he was discharged it was somebody's duty to ascertain he was fit enough to travel and, if not, to take steps to get him so before he was sent away.

A further instance of this comes from Gosport in September 1593. On account of contrary winds a batch of eighty-eight sick men were landed unexpectedly at that town. Instead of being packed off home straight away, they were allowed to rest for two days at Gosport, and received pay during that period. Two died, and seventy-seven of the remainder were then given travelling money, calculated on the basis that they would only be able to walk eight miles a day. The remaining nine men were retained at Gosport until they had recovered from their illnesses (C.S.P.D., 1591-4, p. 374).

Furthermore, it had come to be realized, before the end of the century, that the community was under an obligation to those soldiers who had been

incapacitated in the service of their country. Means were taken for their relief, but this is too large a subject to be taken up in this paper, and must be left to some future date.

From now onwards it was the established practice to evacuate the sick from the theatre of war to the home base. In the French campaign of 1597, on account of the loss of Amiens, some of the English troops had to move in a hurry (Salisbury, vii, p. 102). They had to abandon their baggage and some of their sick ; nevertheless, a large number of the sick were got away and evacuated to England. On this occasion it fell to the lot of Dover to look after most of them. The authorities of that town were put to a good deal of expense in caring for those who were unable to travel, in issuing money to those who could, and in burying those who died. They wrote to Cecil, asking him to reimburse them for these charges, and at the same time urged him to send them a supply of corn which had become scarce on account of the influx of the troops (*ibid.*, p. 157).

In Ireland the same procedure was carried out, as various references in the Calendars of State Papers show. However, in 1599, it occurred to certain people that this was not an economical policy. Large numbers of men were sent back to England, who never returned to Ireland. Their places were taken by drafts of new and unseasoned men, who were not inured to the climate and conditions under which they had to live in that country, with indifferent food and poor lodgings. As a result they went sick in large numbers from the country disease—dysentery—and they, in their turn, were also evacuated to England ; and so the vicious cycle went on. Why not stop all this, and institute Guest Houses or Hospitals, such as were to be found in Holland, where the sick could be looked after and nursed back to health ? If this were done, the men, after their recovery, would be of three times the value to the Army than they had been before. They would have established an immunity to the prevailing disease, and would more easily become inured to the hardships that they would have to endure in such a primitive country. In this way the sick-rate would be brought down to a reasonable level ; the Army would be kept up to strength ; the Queen would be saved the expense of hiring transport for the evacuation of the sick, and also the cost of having to supply large numbers of new soldiers every year to take the place of those who had died, or had been invalided (C.S.P.I., 1599–60, pp. 334 and 350). To show how great this wastage was, it was generally accepted that any body of troops, six months after landing in Ireland, lost about 50 per cent of its strength. Although a certain proportion of this loss was due to men slipping back to England, or even deserting to the Irish, the greater part of the wastage could only be accounted for by death and disease.

Once the question of establishing hospitals was raised, it was given the most serious consideration, and at the highest level. In the Calendars of the Irish State Papers and the Carew Papers there are a number of papers bearing on this subject. It is, however, interesting to note that even earlier than this, in 1598, some of the leading citizens of Dublin proposed founding a military hospital in that city. At a cost of £1,000 a year they proposed to establish a hospital of fifty beds, which, according to the practice of the period, would

accommodate a hundred patients. A staff of half a dozen nurses and a surgeon were also to be provided (Cruikshank, p. 124). Nothing came of this scheme, and it was only when the matter was taken up by the Privy Council that anything concrete was decided upon. Lord Buckhurst proposed that a hospital should be provided in Ireland, fully equipped with everything necessary for the treatment of the sick and wounded (C.S.P.I., 1590-1600, p. 377). Lord Mountjoy, the Lord Deputy elect, went into greater details, and recommended that hospitals should be established at Cork, Dublin, and Drogheda. Each of these hospitals should be under the supervision of two unpaid overseers, "Honest householders of the town." The stipendiary staff was to consist of a Master at five shillings *per diem*, his servant at twelve-pence, and four women at sixpence apiece. The masters were to be either surgeons or physicians, and the hospitals were each to be provided with one hundred beds—presumably for two hundred patients (*ibid.*, p. 448).

As a result of these discussions the Lord Deputy was instructed to erect four hospitals in Ireland (C.C.P., pp. 358-60). Whether all of these were established is uncertain, but a warrant was issued to certain aldermen of Dublin on May 28, 1600, to form a hospital in that city (C.S.P.I., 1600, p. 209), and in October of the same year there is a reference to certain hospitals being in existence in Ireland (*ibid.*, p. 505).

About one of these hospitals a good deal of information is available. This was the one established at Derry, for the sick of the force operating in that area, under the command of Sir Henry Docwra. On the motion of Lord Buckhurst, at a meeting at Richmond at which Docwra was present, it was decided that Sir Henry should be instructed to establish a hospital at Lough Foyle (C.S.P.I., 1599-1600, p. 393). In March the Lord Deputy and his council issued a formal order to Docwra to build this hospital, with materials sent from England for that purpose (C.C.P., p. 375).

The institution of the hospital at Lough Foyle was a very wise move, as the men of that force fell sick in very large numbers. Unfortunately Docwra did not carry out his instructions as fully as he should have done, and only provided a unit of twenty-eight instead of a hundred beds, as had been ordered. His excuse for this omission was that, first he could not get the men to work, and secondly that he had not sufficient material to build a larger structure. It is possible that the general corruption of the times had something to do with it; and it may be that Docwra put money into his own pocket through this transaction. Be that as it may, the above were the excuses offered by Docwra when criticized for not providing a hospital of sufficient size to accommodate the large numbers that fell sick, in the force under his command (C.S.P.I., 1600, p. 406).

The evidence brought forward in this paper shows that important advances were made in the organization of the disposal of the sick and wounded during this century. The evacuation of casualties was controlled by the central authorities; and the individual sick soldier was no longer personally responsible for arranging for his return to his native land. That the State now undertook this duty must have been of benefit to the sick soldiers, and an ultimate

economy to the country. Despite what has been stated by some earlier writers, who affirm that the English Army had no military hospitals until a much later date, it has been shown that such institutions, crude though they may have been, were authorized and established in Ireland before the end of the reign of Queen Elizabeth. True the date is just outside the sixteenth century ; but these hospitals were a direct development of that century, and must be considered part and parcel of the medical service of that period.

RADIOTHERAPY AND MALIGNANT DISEASE

BY

Colonel W. A. D. DRUMMOND, *O.B.E.*, *F.R.C.S.*, *D.L.O.*

UNDER the ægis of the Director and Consultant Surgeon the liaison between the Radiotherapy Department of Westminster Hospital and The Queen Alexandra Military Hospital has been enhanced and strengthened necessitating the development of the Tumour Register at the Department of Pathology in the Royal Army Medical College and the establishment of a scheme for the collection and disposal of cases.

During the year 1948 a considerable advance has been made so that now it can be rightly acclaimed that any officer or other rank, his wife or child, who is affected by malignant disease or any lesion requiring radiotherapy, has, at his or her immediate disposal, consultant opinion and treatment second to none.

We present an account of the work carried out in conjunction with the Radiotherapy Department of Westminster Hospital. The liaison with this hospital is on an unofficial basis and is the result of a common goodwill. During the past year 108 new cases have been seen necessitating over 2,000 visits to Westminster Hospital for consultation and therapy.

All Army personnel from overseas, and their families and a number of those at home who require radiotherapy, are now sent to the Queen Alexandra Military Hospital for disposal.

On admission the case is examined, the medical documents are summarized and X-rays and histological material perused. If necessary, clinical photographs are taken so that the case may be presented to its best advantage before the consultant panel.

The blocks and histological slides of biopsies, more often than not, now precede the patient and are collected from the Tumour Registry of the Department of Pathology at the Royal Army Medical College. One copy of the case summary is filed at The Queen Alexandra Military Hospital, a duplicate is handed to Westminster Hospital, a third copy is sent to the Tumour Registry and a fourth to the Medical Officer who referred the case. Should the case be one of malignant disease it is registered under the British Empire Cancer Campaign by Westminster Hospital.

The policy of the Westminster side of the liaison is to stimulate and encourage surgeons in the Army to undertake the operative surgery of their own cases and, to facilitate this, radon seeds and radium needles are made available for use in the wards of The Queen Alexandra Military Hospital. Where special surgical measures are required, guidance and actual assistance are readily given by the Surgeons of the Radiotherapy Department.

We give a note of the treatment deemed most appropriate by the consultant panel for the particular case. In regard to the tongue, breasts, testis and reticulo-endothelial system, a summary of the procedures adopted and advocated by the Radiotherapy Department is also included. It will of course

be realized that, owing to the rapid development of methods for the treatment of malignant disease, e.g. isotopes, hormones and the possible 100 grm. bomb, etc., the procedures described may soon be superseded. The inclusion of notes of this kind in future Annual Reports should prove a reliable and ready source of information for all who are interested in malignant disease in the Service.

SUMMARY OF CASES PRESENTED FOR TREATMENT DURING 1948

					Benign	Malignant	Total
Officers	Male	..	..	..	7	25	32
	Female	..	..	..	1	3	4
O.R.s	Male	..	..	..	16	49	65
Families	Women	..	..	..		3	3
	Children	..	..	..	2		2
Other Services	..	..	..	..		1	1
All Others	..	..	..	..		1	1
					26	82	108

DISEASE FOR WHICH THESE PATIENTS ATTENDED

(1) BENIGN CONDITIONS.

A. Congenital.

Vascular :—

(a) Of nose.

<i>Naevus flammeus.</i>	O.R.	1	Total
<i>capillary.</i>	Families	2	

Treatment: Surface applications of radium are giving way to the use of local multi-point injections of quinine urethane m.1, into the edge of the lesion.

(b) Of external auditory meatus.

<i>Venous hæmangioma.</i>	W/Serv.	1	Total
Opinion: Radiotherapy is contra-indicated.						

Advised observation and follow up.

(c) Of pinna.

<i>Cavernous hæmangioma.</i>	O.R.	1	Total
Treatment: Two implantations of radium needles for 48 hours' duration separated by an interval of three months. The object is to produce an obliterative endarteritis of the affected vessels. The pinna has diminished in size.						

(d) Of lip.

<i>Arteriovenous fistulæ.</i>	O.R.	1	Total
Treatment: Two courses of surface application of radium in a specially designed acrylic applicator totalling 3,000 r. Between the courses (one month) the affected vascular bundles were ligated. The machinery murmur has disappeared and the tumour has regressed in size.						

(c) Of tongue.

<i>Lymph-hæmangioma.</i>	O.R.	1	7
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Treatment: Excision by diathermy of the central pedunculated mass followed by interstitial radium for 48 hours. The dorsal surface of the tongue is now normal in appearance.

B. *Post-traumatic.*

Total

(a) Of eyelid.

Cicatricial contracture.

Off.

1

1

Treatment: L.V.X'R.* therapy (90 to 140 kV.) followed by a Z plastic incision and suture, the rationale being that the X-ray softens the scar and causes it to regress. Result very satisfactory.

* Low voltage X-ray.

C. *Infective.*

(a) Of bone.

Osteomyelitis chronic.

(i) humerus Off. .. . 1

(ii) femur O.R. .. . 1

At first both of these cases were thought to be osteogenic sarcoma.

Treatment: In C.M. after a course of H.V.X'R.* therapy a biopsy was performed and the diagnosis of a low grade osteomyelitis established.

In one case after due consideration, the case was placed on penicillin. The response confirmed the diagnosis of an osteomyelitis.

* High voltage X-ray.

(b) Of cornea.

Ulcer "Moran's."

O.R.

1

Treatment: H.V.X'R. therapy. Progress has been most satisfactory. There is good evidence that properly planned radiation does not induce adverse changes in the lens.

(c) Of skin.

Boeck's sarcoidosis.

O.R.

1

Diagnosis: Biopsy suggested a reticulosis. The negative response to H.V.X'R. therapy indicated the necessity for a second biopsy which confirmed Boeck's sarcoidosis.

(d) Of vertebræ.

Spondylitis deformans.

Offs.

5

O.R.s

3

12

Treatment: Two courses of H.V.X'R. therapy each 1,200 r to the affected vertebræ. There was an amelioration of symptoms in all cases.

D. *Neoplastic.*

(a) Of vocal cord.

Hæmangioma.

O.R.

1

Treatment: Avulsion of tumour. Result satisfactory. Radiotherapy was not indicated.

(b) Of radius.

Osteoclastoma.

O.R.

1

Treatment: H.V.X'R. therapy. The tumour regressed in size *pari passu* with increased calcification of the tumour and the surrounding bone.

(c) Of leg.

Neurofibroma.

O.R.

1

Treatment: Surgical removal. No indication for radiotherapy. Satisfactory.

(d) Of parotid gland.

Salivary tumour.

O.R.

1

4

Treatment: Local removal, followed by H.V.X'R. therapy 6,000 r to the tumour site.

Clinical condition good.

E. *Metabolic.*

(a) Of bone.

Osteitis fibrosa cystica.

Maxilla and Sphenoid.	O.R.s	2	2
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Diagnosis: Confirmation by biopsy. Observation and strict follow up.

(2) LOCALLY MALIGNANT CONDITIONS.

A. *Basal-celled Carcinoma (Rodent Ulcer).*

Offs.	..	..	..	6	
O.R.s	..	..	..	3	
W/Serv.	..	..	..	1	
Families	..	..	..	2	12

Treatment: Surface applications of radium were used in two cases, X-ray therapy (Chaoul 60 kV.) in two and radon seeds in another.

Implantation of radium needles was the method of choice in the remainder.

Results were most satisfactory.

(3) MALIGNANT CONDITIONS.

A. *Epithelial in Origin.*

(a) Of skin.

(i) <i>Epithelioma.</i>	Offs.	..	..	..	3	
	O.R.s	..	..	..	2	

Treatment: In one case radium needles were implanted, in the remainder surface application was the method of choice. Response excellent except in one case who developed metastases in the fourth dorsal vertebra.

(ii) <i>Melanoma.</i>	O.R.	1	6
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Primary had been surgically removed.

Treatment: H.V.X'R. therapy to cervical lymph nodes; for close observation.

(b) Of lip.

<i>Epithelioma.</i>	Offs.	..	..	..	2	
	O.R.	..	..	..	1	3

Treatment: Implantation of radium needles.

Clinical cure in all cases.

(c) Of tongue.

<i>Carcinoma.</i>	O.R.s	3	3
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Treatment: Implantation of radium needles is the treatment of choice for a primary lesion situated on the anterior two-thirds. If the lymph nodes are inoperable H.V.X'R. therapy or, radium implantation is used. Growths of the posterior one-third of the tongue are treated by telerradium and H.V.X'R. therapy.

(d) Of hypopharynx.

<i>Carcinoma.</i>	O.R.	1	1
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Treatment: Telerradium (palliative) through two opposite ports was the method employed.

Marked amelioration of symptoms.

(e)	Of œsophagus.						Total
	<i>Carcinoma.</i>	O.R.	..	..	..	1	1
	Treatment: H.V.X'R. therapy, palliative.						
(f)	Of cæcum.						
	<i>Carcinoma.</i>	O.R.	..	..	..	1	1
	Treatment: Condition too advanced for H.V.X'R. therapy.						
(g)	Of antrum.						
	<i>Carcinoma.</i>	Offs.	..	..	..	2	2
	Treatment: H.V.X'R. therapy followed by fenestration of the palate and later intra-cavity application or radium. One case a clinical cure; the other under treatment.						
(h)	Of œsopharynx.						
	<i>Carcinoma.</i>	Off.	..	..	..	1	1
	Treatment: The primary was not located. H.V.X'R. therapy was the treatment of choice.						
(i)	Of bronchus.						
	<i>Carcinoma.</i>	Offs.	..	..	..	2	
		O.R.s	..	..	..	2	4
	Treatment: H.V.X'R. therapy was the treatment selected.						
(j)	Of breast.						
	<i>Carcinoma.</i>	W/Serv.	..	..	..	1	1

The average life of an untreated case is three years nine months. Of all the factors influencing the prognosis in carcinoma of the breast, the stage of the disease is the most important and it entirely governs the choice of treatment.

Stage I.

A "mass" in the breast with no involvement of the lymphatic nodes, deep fascia or skin. Radical amputation, followed by *post-operative* H.V.X'R. therapy aiming at a minimum tumour dose of 3,000 to 3,500 r. With this form of treatment a five-year symptom-free period is to be expected in 84 per cent of cases.

Stage II.

A "mass" in the breast with only enlargement of the lymphatic nodes. *Pre-operative* H.V.X'R. therapy to a tumour dose of 3,000 to 3,500 r followed by radical amputation. A five-year symptom-free period can be expected in 40 per cent of cases.

Stage III.

A "mass" in the breast with skin and lymphatic node involvement. H.V.X'R. therapy, *no operative interference*.

Stage IV.

Carcinoma of the breast with skeletal metastases. The treatment of choice in these cases is by hormones and H.V.X'R. therapy.

(k)	Of testis.						Total
(i)	<i>Carcinoma.</i>	Offs.	..	..	..	4	
		O.R.	..	..	..	1	
(ii)	<i>Teratoma.</i>	Offs.	..	..	..	2	
		O.R.s	..	..	..	5	12

It is now recognized by all authorities that following operation the treatment of the lymph drainage area by H.V.X'R. therapy increases the expectancy of a five-year symptom-free survival period by 100 per cent.

If there are no palpable lymph nodes and the patient is given, *within twenty-one days of operation*, the benefit of H.V.X'R. therapy to the lymph drainage area

of the affected testicle, a five-year symptom-free survival period is anticipated in 64 per cent of cases.

If at operation, a case presents involvement of the para-aortic, supra-clavicular or mediastinal lymph nodes, and H.V.X'R. therapy is given, a five-year symptom-free survival period can be expected in 34 per cent.

B. Sarcoma.

(a) Osteogenic.

	O.R.s	..	..	..	2	
Femur	O.R.s	..	..	..	2	
Tibia	O.R.	..	..	..	1	
Fibula	O.R.	..	..	..	1	
Hip	O.R.	..	..	..	1	6

The life-history of sarcoma of the long bones shows it to be a very fatal disease. For a time the neoplasm grows and may produce daughter tumours which bud out from the surface of the original growth. At a later period the tumour metastasizes and secondary deposits are then to be found in the lungs and other bones.

Sarcomas very seldom ulcerate through the skin (except when a breach has been made, e.g. for purpose of biopsy), death occurring first from pulmonary metastases.

In cases of early sarcoma of long bones, the American Registry of Bone Tumours and other authorities have found that immediate amputation of the affected limb resulted in an earlier death than if the tumour had been allowed to take its natural course.

Radiation of the tumour area induces a regression in size with increased calcification of the tumour and the surrounding bone, giving both the medical attendant and the patient a false sense of security. These cases usually develop pulmonary metastases and die within twelve to eighteen months from the time of the recognition of the disease.

At the present time the treatment adopted for sarcoma of bones of the extremities, provided there are no pulmonary metastases, is a maximum of H.V.X'R. therapy, 4,000 to 5,000 r tumour dose over a period of three to four weeks to the affected part. Then, after a short rest period, a fore-quarter amputation in the case of the upper extremity, or a disarticulation in the case of the lower, is carried out.

In the lower extremity the question arises whether or not amputation at the level of the lesser trochanter would suffice. The answer is no, as the muscles and tendons overlying and attached to the tumour may contain sarcomatous cells; therefore these muscles are best erased from the os innominatum by means of diathermy. The hind-quarter amputation is the ideal but its high mortality weighs heavily against its adoption.

(b) Ewing's sarcoma.

	O.R.s	..	..	..	2	2
Humerus.	O.R.s	..	..	..	2	2
Treatment: Essentially the treatment here is the same as for osteogenic sarcoma; the prognosis is, however, on the whole better.						

(c) Chondrosarcoma.

	O.R.	..	..	..	1	1
Ethmoid.	O.R.	..	..	..	1	1
Treatment: A course of pre-operative H.V.X'R. therapy was used to "sterilize" the tumour field. As all the tumour could not be removed via the nostril, fenestration of the palate was performed to gain access for complete extirpation and intra-cavity radiation.						

(d) <i>Fibro-sarcoma.</i>					<i>Total</i>
(a) Orbit-ethmoid	O.R.	..	..	..	1
(b) Vulva	All Others	..	..	..	1
Treatment: (a) Following confirmation by biopsy, a maximum dose of H.V.X'R. therapy was given to the orbit with regression in the size of the tumour. The orbit and its contents were extirpated by diathermy. The ethmoid and bony roof of the orbit were then removed and the resulting cavity lined by a full thickness skin graft.					
(b) Surgical excision. Radiotherapy was contra-indicated.					
(e) <i>Fibro-myo-sarcoma.</i>					
Vastus medialis.	O.R.	..	..	..	1
Treatment: Surgical removal followed by post-operative H.V.X'R. therapy.					
(f) <i>Round-celled.</i>					
Retro-peritoneal.	O.R.	..	..	..	1
Treatment: Surgical exploration. Radiotherapy was contra-indicated.					
(g) <i>Synovioma.</i>					
Flexor muscles of thigh.	Families	..	..	..	1
Treatment: Surgical excision. Followed by H.V.X'R. therapy. For close observation and follow up.					
(4) RETICULOSIS.					
A. <i>Lymphoid Follicular.</i>	O.R.	..	..	..	1
B. <i>Fibro-myeloid.</i>	Off.	..	..	..	1
	O.R.s	..	..	..	12
It is of interest to note that one case was considered to be a splenic anæmia and had a splenectomy performed. For a time he did well. Later he reported with lymphadenopathy; biopsy revealed lymphadenoma.					
C. <i>Reticulo-sarcoma.</i>	Off.	..	..	..	1
	O.R.s	..	..	..	2
D. <i>Hæmic myeloid.</i>	Off.	..	..	..	1
	O.R.s	..	..	..	3

Under the heading of reticulosis are included all the cases of tumours affecting the lymph nodes and the blood. These diseases are uniformly fatal, survival varying from a few months to several years. No form of treatment has yet been found to cure them. H.V.X'R. therapy (over 220 kV.) and modern treatments not only increase the comfort of the patient but in most cases undoubtedly prolong the life, *but only if treatment is applied early in the disease.* Of the present series, one patient died in hospital, the others are all living comparatively normal lives.

WHAT HAS THIS COLLABORATION ACHIEVED ?

In the past ground for complaint has arisen owing to delay in treatment. This liaison brooks no delay and in point of fact affords Service personnel and their families priority treatment.

From the patient's point of view the feeling was well expressed by Pensioner Murphy, aged 82, late Royal Artillery, who, after radium treatment for carcinoma of the tongue and floor of the mouth, when asked how he was, used the old expression of deep significance "It's all Sir Garnet." The phrase

refers to Sir Garnet Wolseley, who, as Commander-in-Chief of the Army at a period of adversity very similar to the present one, busied himself in raising the morale of the soldier. To the Army of Kipling's day the expression implied that everything humanly possible was being done without delay to help the soldier.

With regard to malignant disease, Medical Officers in any part of the world can now assure their charges that, "It's all Sir Garnet." The effect on the morale of the patient's comrades is good. They all realize that when their friend reaches The Queen Alexandra Military Hospital he will have immediate access to professional opinion second to none, and his treatment will commence within two or three days of his arrival. The scheme also affords great comfort to the patient's relatives and rightly warrants the old expression of the Pensioner.

It was considered that this aspect of medicine was only palliative, but this is untrue. Most of the cases listed in paragraphs 2, 3 and 4 have been given a new lease of life, be it only five years, as useful soldiers or citizens.

The success of the liaison has been due to two principal factors :

In the Radiotherapy Department of Westminster Hospital, nothing has been of too trivial a nature or too big a task for the team to undertake. If some special treatment has been required which could not be given at Westminster Hospital, Dr. F. M. Allchin has treated the patient at his rooms. Sir Stanford Cade has, on several occasions, loaned his personal radium, and has come to Millbank to operate and demonstrate his technique. In addition, Mr. Stanley Lee has given help and advice. Dr. C. W. Wilson and his staff of the Department of Physics have been most patient and helpful. Sincere thanks are also due to Miss P. Wheatley whose tact and guidance have been superb, and to those Medical officers of the "Corps" dispersed over the world who without diffidence loyally supported the scheme.

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Clinical and Other Notes

REPORT OF CLINICAL MEETING

Held at 94 (Hamburg) British Military Hospital B.A.O.R., on Friday, November 19, 1948

The speakers were introduced by the Chairman, Lt.-Col. J. Mackay-Dick, R.A.M.C., Officer i/c Medical Division.

Captain R. W. E. Watts, R.A.M.C., gave a brief account of four cases of leptospirosis canicularis (canicola fever) which had been treated in the Medical wards of the hospital during the previous three months. All four cases presented with between four and nine days' history of fever, malaise, headache and gastro-intestinal symptoms. Three developed a leptospiral meningitis with non-specific cerebrospinal fluid changes comprising an increase in polymorphonuclear and lymphocytic cells. Protein was increased in all three cases and globulin in one. One case showed hepatic and renal involvement with jaundice, lowered plasma prothrombin level and azotæmia. This case also developed pulmonary infiltrations. Important points from the aspect of early clinical diagnosis were severe headache with retro-orbital pain, injected conjunctivæ, injected pink optic disc with albuminuria and microscopic hæmaturia. The importance of serial leucocyte counts in differential diagnosis was stressed. The diagnosis was established in each case by the demonstration of a rising titre of agglutinin to *Leptospira canicola* in the patient's blood.

None of the cases recorded showed skin manifestations or splenomegaly. A mild degree of generalized lymphadenopathy was observed in two of the four cases recorded.

Treatment was symptomatic in the three cases of "meningeal type." The case with hepatic and renal and pulmonary involvement was treated with penicillin, 30,000 units three-hourly for nine days, but relapsed as soon as this was discontinued. Subsequent treatment with 60,000 units three-hourly for twenty-one days proved successful.

Two convalescent patients were present at the meeting.

It was suggested that two of the patients might have acquired their infection by bathing in water contaminated by the urine of infected dogs. The remaining two patients both keep pet dogs. The serum of one dog agglutinated *L. canicola* suspensions in a dilution 1/1,000. Further details of the four cases are given in the appended tables.

[A full report of these cases will appear elsewhere in due course.]

Major H. J. Voss, R.A.M.C., dealt with the clinico-pathological problems of diagnosis. He stressed the difficulty of demonstrating leptospiræ in the urine of patients suffering from this disease. Approximately eighty specimens

of fresh warm alkaline urine collected at all stages of the disease from the four cases described by Captain Watts had been examined with negative results. Intraperitoneal injection of the guinea-pig had proved unsuccessful. *Cyrcetus auratus* (the "golden hamster") is the laboratory animal most susceptible to experimental infection by this organism. Major Voss agreed with Captain Watts that demonstration of a rising titre of antileptospiral agglutinins represents the most certain way of confirming the presence of *Leptospira canicola* infection.

The chairman felt it difficult to believe that such cases were now just arising and considered that in the past such cases in Germany might have been missed and diagnosed as P.U.O., gastro-enteritis, albuminuria, benign meningitis, etc. He stressed the need for the performance of all relevant tests in all cases of pyrexia of uncertain origin, not to regard albuminuria in febrile cases as being necessarily febrile albuminuria and to consider a lumbar puncture in all such cases in the presence of persistent headache and neck stiffness, however slight, even in the absence of Kernig's sign.

TABLE A

	Case I	Case II	Case III	Case IV
Mode of onset	Malaise. Feverishness. Abdominal pain. Constipation. Vomiting. Headache generalized	Malaise. Feverishness. Diarrhoea and watery stools. Headache - generalized. Cough and sputum. Myalgia	Malaise. + Feverishness. Constipation. Headache - generalized. Cough unproductive. Myalgia. Arthralgia	Malaise. Feverishness. Nausea. Vomiting
Date of admn.	5th day	9th day	4th day	5th day
Temperature on admission	102° F.	100° F.	101.8° F.	101° F.
Signs on admission	Tender R. upper quad. Urine: trace of albumin. C.D.: R.B.C. occ.	Pink discs. Nyctagmus to Rt. Injected conjunctivæ and ecchymosis in inferior fornix. Furred tongue.	Conjunctival injection. Tongue furred.	Fever only.
History relevant to mode of infection	Bathing	Bathing	Lap-dog	Lap-dog. ? contact with vegetables.
Duration of fever	41 days	21 days	22 days	41 days
Duration of hospital	21 days	30 days	21 days	53 days

TABLE A (continued)

<i>Date of admn.</i>	<i>Case I 5th day</i>	<i>Case II 9th day</i>	<i>Case III 4th day</i>	<i>Case IV 5th day</i>
Meningeal signs	9th day of disease	11th day of disease	8th day of disease	Nil
Jaundice detected	—	—	—	6th day of disease
Hæmorrhage tendency	—	Epistaxis during week before admission to hospital.	—	Hæmoptysis 7th-9th day. Prolonged prothrombin time.
Blood urea (mg. %)	10th day : 20	14th day : 30	6th day : 40	9th day : 60 15th day : 30
Urine - Albumin R.B.C. casts	On admission	Never	On admission	6th day
Pulmonary involvement	Nil	Nil	Nil	Yes : commenced on 9th day.
Conjunctival injection	On admission	On admission	On admission	First detected on 9th day of illness.
Injection of optic disc	Not recorded	Yes	No	Yes
Retro-orbital pain	+	+	+	+
Joint and muscle pain	+	+	+	+

TABLE B.—CEREBROSPINAL FLUID

<i>Case</i>	<i>Day</i>	<i>Total mm³.</i>	<i>Cytology %</i>	<i>Protein mg. %</i>	<i>Globulin</i>	<i>Chloride mg. %</i>	<i>Pressure mm.</i>
I	9	169	Polys. 20 Lymphs. 80	100	No excess		
	12	70	Polys. 12 Lymphs. 88	35	No excess		
II	10	130	Polys. 20 Lymphs. 80	70	No excess	740	120
III	7	446 opalescent	Polys. 64 Lymphs. 36	80	Excess		260
	14	35	Polys. 11 Lymphs. 89	40	Sl. excess	740	
	21	10	Lymphs. 100	20	No excess	760	
	27	6	Lymphs. 100	20	Sl. excess	760	

TABLE C.—TABLE OF DIFFERENTIAL WHITE COUNTS

Case	Day	Total per mm ³ .	Polys. %	Lymphs. %	Eos. %	Basos. % mm ³ .	Monos. %	Others
I	5	11,800	80	19		1	118	
	6	11,800	76	19				
	14	12,600	63	34				
II	10	9,400	62	32	4	1	1	
	14	10,600	65	32		2	1	
III	4	14,700	70	25	3	2		
	5	14,800	81	17				
	7	14,400	76	16	4		4	
			(metamyelocytes and myelocytes 5% total cells)					
	9	12,200	80	14			3	
	13	15,600	65	29	2		4	
	17	21,400	84	16				
	21	16,450	67	30	1	2		
IV	5	16,000	70	30				
	9	23,200	79	15	(6% total cells atypical lymphos. 1 of these actually mitosing)			
	13	14,200	71	25			3	
	*15	8,000	74	21	1	1	3	
	20	17,250	80	16	3	1		
	26	17,200	53	37	6	2	2	
	29	34,000	57	33	8			

* Penicillin discontinued.

TABLE D.—AGGLUTININ TITRES

Day of disease	Case I		Case II	
	7th	16th	16th	50th
<i>L. canicola</i>	+ at 1/100	+ at 1/3,000	+ at 1/300 Trace of at 1/1,000	+ at 1/300 ± at 1/1,000
<i>Leptospira ictero-hæmorrhagica</i>	Neg.	Neg.	Neg.	Neg.
Day of disease	Case III		Case IV	
	5th	17th	21st	7th
<i>L. canicola</i>	Neg.	+ at 1/1,000	+ at 1/1,000 ± at 1/3,000	+ at 1/100 ± at 1/300 ± at 1/1,000
<i>Leptospira ictero-hæmorrhagica</i>	Neg.	Neg.	Neg.	+ at 1/10 ± at 1/30
				+ at 1/1,000
				+ at 1/100 trace at 1/300

Major J. J. McGrath, R.A.M.C., demonstrated a case of Korsakoff's syndrome and **Lt.-Col. J. D. F. Murphy, R.A.M.C.**, Adviser in Psychiatry, discussed the features of the case with special reference to the modern views on ætiology, treatment and prognosis. Other cases presented were :

Unilateral optic atrophy with a history of old head injury (**Lt.-Col. J. B. George, R.A.M.C.**, Ophthalmologist).

Aneurysm at the bifurcation of the left common carotid artery in a man aged 41 years with B.P. 115/70 and evidence of generalized arteriosclerosis (**Major G. B. L. Laird, R.A.M.C.**, Medical Specialist).

Right submandibular lymphadenopathy for diagnosis (**Captain W. Cunningham, R.A.M.C.**, Venereologist, and **Captain John Butler, R.A.M.C.**).

Sphenopalatine neuralgia (**Lieutenant G. Freeman, R.A.M.C.**, Otologist).

Traumatic hæmopneumothorax with special reference to treatment. (**Captain R. W. E. Watts, R.A.M.C.**).

ACHOLURIC FAMILY JAUNDICE

BY

Lieutenant-Colonel J. A. M. CAMERON

ACHOLURIC JAUNDICE is sufficiently rare in infancy to make the following case worth recording.

CASE REPORT

In July 1940 the 3-year-old child of a Warrant-Officer came under my care. This little boy was a deaf-mute, mentally retarded, and with a patent anterior fontanelle. Whenever the child caught a cold it became mildly jaundiced. The morning after seeing him I had occasion to have the father before me for medical board proceedings, and the remainder of this report concerns the latter. All previous records were to hand.

Born in Lancashire 1906. Passed fit for the Army October 17, 1926.

British Military Hospital Gharial, July 15 to 23, 1929. Tonsillitis with jaundice.

Lichfield, May 3, 1933, to July 20, 1933. Acholuric jaundice. Enlarged spleen, icteric conjunctivæ, no bile in urine. No further change in condition.

York, July 20, 1933, to August 12, 1933. Acholuric jaundice. Diagnosis confirmed. Red cell fragility definitely increased. No other cause was found for the enlarged spleen and jaundice. Operation was considered but not advised at present.

Preston, October 11, 1935, to October 21, 1935. Fairly well-marked icterus dating from childhood and increasing recently. No history of gastric disturbance. Spleen much enlarged and slightly tender. Urine shows no bile. Blood: Slight increase in polymorphs and increase in red cell fragility (range unstated).

Transferred to Catterick Hospital, October 21, 1935. Spirochætal jaundice. Source of infection not ascertained, but considered to be a very mild attack of spirochætal jaundice superimposed upon acholuric jaundice. No rash, hæmorrhages, or nerve symptoms. Spleen enlarged to 2 in. below navel. Traces of bile in urine on admission

but later disappeared. Spirochaetes present in the peripheral blood in large numbers, later disappearing. Increased blood clotting time (twelve and a half minutes) with normoblasts and megaloblasts, with anisocytosis (chiefly microcytes) and poikilocytosis and chromatophilia. W.R. and Kahn tests negative. Evening rises of temperature to 100° F. Subcutaneous injections of Sulphostab 0.22 gramme, 0.35 gramme one week later, and 0.45 gramme ten days later. Temperature became normal on the fifth day. No spirochaetes found in the blood after the fifteenth day from the commencement of treatment. No spirochaetes found in the centrifuged urine. Agglutination test negative. Discharged to duty.

Catterick, May 15, 1936. Acholuric family jaundice. Icterus of the skin and conjunctivæ. Blood picture: microcytes with chromatophilia. R.B.C. 5,500,000; W.B.C. 7,300; Hb 80 per cent; colour-index 0.8. Fragility and coagulation time normal. Urine contains urobilin. Splenectomy recommended, since at present he is not fit for service abroad.

B.M.H. Madras, December 29, 1937, to January 15, 1938. Splenomegaly with acholuric jaundice, together with anæmia. Given iron and arsenic, and fresh ox liver by mouth.

B.M.H. Karachi. Admitted July 12, 1940.

This Warrant Officer has never had malaria.

Family History.—Married, youngest child aged 3 years, who also suffers from intermittent attacks of acholuric jaundice. This child is truly "a chip off the old block" in so far as clinical findings and facial features are concerned.

Past.—Patient is now 34 years old. Has never had a hæmolytic crisis and general health has always been good despite repeated minor episodes of jaundice, usually during an infective fever. In "normal health" the icterus never completely leaves the scleræ. At one time his spleen was enlarged down to the iliac crest. There is no history of jaundice in this man's relatives.

Condition on Admission.—This man is a good specimen and has no symptoms apart from a feeling of weight in the left side of the abdomen. The scleræ show mild icterus and the spleen is hard and enlarged as far as the level of the navel, being smooth and notched anteriorly. The stools are normal in colour and the urine shows no bile.

Laboratory Report.—Red cell sedimentation rate, 19 mm. in one hour.

Blood.—R.B.C. 3,600,000; Hb 80 per cent; Sahli (14.5 grammes per 100 c.c.); W.B.C. 14,200, differential count normal.

Blood smear: no malaria parasites nor Leishman-Donovan bodies, microcytosis marked. Van den Bergh test: indirect positive, direct test is delayed. Reticulocytes 8 per cent. W.R. negative (24.7.40). Red cell fragility test: commencing hæmolysis in 0.5 and complete in 0.40 per cent saline (control tests were used).

Blood Group IV/o.

Operation.—Splenectomy on July 23, 1940. Chloroform and ether anæsthesia, with concurrent whole blood transfusion 700 c.c. (drip). There were no splenic adhesions, no gall-stones, and the appendix was normal. The greatly enlarged spleen was removed by the classical method. About 8 oz. of blood remaining in the splenic bed was returned via the drip to the vein. Pulse remained below 100/min. throughout.

On September 20, 1940, I had a swim with the patient, and did not see him until 1944 when we met in a bar while on leave from the Burma Campaign. He was then a robust Captain, in Category A, and had had no further symptoms.

I have great pleasure in acknowledging the help given me by my late C.O. and medical colleague Major-General Sir Alexander Biggam, sometime O.C. the B.M.H. Karachi, India.

REFERENCE

ASHBY, H. T. (1940) *B.M.J.*, April 27.

MILITARY WIDOWS' FUND

President : The Adjutant-General to the Forces

THE Military Widows' Fund previously existed in India where it operated for over one hundred years for the benefit of the families of officers of the British Service.

The assets of the Fund (amounting to over £100,000) were handed over to a newly constituted fund in the United Kingdom in 1948 with the same object, viz. :

“ To provide a sum of money for the immediate needs of the widows and children of subscribers to the Fund who die when serving overseas and to alleviate the distress of such relatives without having recourse to the process of circulating subscription lists.”

Membership is open to all officers holding commissions in the Regular Army (British Service) on the active list and who are serving in a command other than those located in Great Britain, Ireland and the Channel Islands.

Such an officer can become a subscriber to the Fund from the moment he embarks for an overseas command. The subscription at present is £3 annually whilst serving overseas. The benefits payable to his widow, should he die while on the strength of an overseas command, are at present £900. The rate of subscription and the amount of the benefits are based on the present ability of the Fund to meet commitments and they are both liable to variation should actuarial examination prove this to be necessary. Due notice would be given before any changes were made. The benefits are payable immediately without any formalities and subject only to verification of the report of a member's death. They are payable only to his widow or an agent appointed by her. If he is a widower with dependent children he may become a subscriber and the benefits are payable to his children. Dependent children are regarded as those under 21 years of age and, if daughters, unmarried at the time of the subscriber's death. Step-children and legally adopted children are included.

The Fund is impressed with a Charitable Trust and The United Services Trustee is Custodian Trustee. A Committee of Officers on the Staff of the Adjutant-General's Department at the War Office administer the Fund as Managing Trustees under his Presidency.

Subscriptions are payable in advance by Banker's Order only. Officers serving, or under orders for, overseas, who wish to join, should write to :

The Secretary,

Military Widows' Fund,

Room 634, Lansdowne House,

Berkeley Square, W.1.,

for an application form and banker's order form.

A copy of the Constitution and Rules and the Standing Orders is issued to all subscribers.

Reviews

THE ACUTE ABDOMEN IN RHYME BY ZETA. Published by H. K. Lewis & Co., Ltd. Price 6s.

This little book of cautionary tales in rhyming verse appears in its second edition and opens thus :

“ The use in rhyme in teaching is quite small
 Its limitations great and plain to all.
 But use it has, although it may be merely
 To put some things more quaintly or more clearly.”

It is a very readable book and some lesson of vast importance is driven home on every page. It

Gives deviations from the norm
 in an assimilable form.

D. F.

RECENT ADVANCES IN RESPIRATORY TUBERCULOSIS. Fourth Edition. By Frederick Heaf, M.A., M.D., F.R.C.P., and N. Lloyd Rusby, M.A., D.M., F.R.C.P. London : J. & A. Churchill Ltd. 1948. Pp. 290. Price 21s.

It is now eleven years since the third edition of this book appeared under the authorship of Dr. L. S. T. Barrell whose death ten years ago interrupted its further development. The new authors facing a considerable breach and a widened horizon have broadened its scope. They review all aspects of the disease in the individual, and the work in its new form also embraces the aspects of the disease which depend on environment and social conditions, considered from the viewpoint of the individual, the community and the national health. Their review of the disease in the individual will be found to meet adequately all requirements of reference of those engaged in the management of cases in so far as this is possible under present conditions of the chemotherapeutic aspects of treatment with many substances under submission to trial. In their preface they state that their policy has been to make this largely objective and to refrain from stating their own views dogmatically. Occasionally, however, in order to give a properly balanced view, an expression of their personal judgment is given.

The wider reaches of the problems presented by tuberculosis are admirably summarized in chapters on rehabilitation and the public health services. These give much useful information on relevant legislation up to and including the coming into force of the National Health Service Act, and are a ready means of access to an appreciation of the methods by and extent to which the fight against the disease is being carried out in this country.

J. B.

THE PRINCIPLES AND PRACTICE OF RECTAL SURGERY. Fourth Edition.

By W. B. Gabriel. Published by H. K. Lewis & Co., Ltd. Price 45s.

This book, which has now reached its fourth edition, has rightly become a surgical classic. Figures, references, etc., have been brought up to date, and a new chapter on anal incontinence added. Rectal conditions are especially common in our overseas surgical practice, and this very practical book is the more valuable in that the details of procedures are given with crystal clarity. The whole field of rectal operations is not covered. There is, for instance, no description of the Miles operation, but there will be pleasure and profit in reading and possessing this book for it is one to which frequent reference will be made where any rectal problem is concerned.

The Publishers are to be congratulated on the excellence of the presentation.

D. C. McC. E.

Notices

ARMY RESERVES OF OFFICERS

THE War Office announce that the lists of the Army Reserves of Officers are now being revised, and that Officers and ex-Officers of the following classes are invited to join either the Regular Army Reserve of Officers or the Army Officers Emergency Reserve :

- (a) Regular ex-Officers who resigned with less than ten years' service.
- (b) Released emergency commissioned Officers.
- (c) Ex-Officers who have relinquished short service commissions since the end of the war, and
- (d) Retired and released Officers formerly of the Indian Army whether they held regular or emergency commissions.

Officers with the time to spare should join the T.A. but those who cannot do so are urged to apply to join one of the Reserves. Particulars from all Territorial and Auxiliary Forces Associations, Army Recruiting Offices, Regimental Depots or the War Office, S.W.1. Officers overseas should apply to nearest Command G.H.Q., or to the War Office. Separate arrangements have been made for Released Officers of the Supplementary Reserve and Territorial Army, and also released Women Officers.

**R.A.M.C. PRIZE FUNDS COMMITTEE
DETAILS OF PRIZES**

(1) LEISHMAN MEMORIAL FUND.

(a) Silver Medal and $\frac{3}{5}$ of such sum as the fund is able to pay in one year (approximately £30) to the individual Officer of the R.A.M.C. or Officer removed from the Corps but still on the active list, or of the Royal Army Dental Corps, for the best work in any branch of Medicine, Surgery or the allied sciences, or in connexion with the general duties of the R.A.M.C. or the R.A.D.C. brought to the notice of the Committee during the year, but not necessarily carried out or completed during the period.

Published work is usually considered, but is not a fixed condition of the award.

Closing date for 1949 prize : December 31, 1949.

(b) Two prizes each of a bronze medal and savings certificates to the value of $\frac{1}{5}$ of such sum as the fund can pay in one year ; one prize to the N.C.O. or man who is judged to have done the best written examination for Dispenser Part B, and one prize to the N.C.O. or man who is judged to have done the best written examination in any Class 1 qualification other than Dispenser. The latter prize is not awarded more than once to the same individual.

The value of the savings certificates in each case is approximately £10. Further details from the Technical Training Officer, R.A.M.C. Depot.

(2) ALEXANDER PRIZE.

Silver-gilt medal and the remainder of the income of the prize (normally about £70) awarded annually to such person, being a Medical Officer of the R.A.M.C. on full pay, or an Officer still on the active list but removed from the Corps, who, in the opinion of the Trustees, has, by professional work of outstanding merit, done most to promote the study and improvement of Military Medicine, Military Surgery, Military Hygiene or Military Pathology.

Officers on the teaching staffs of the R.A.M.College, and A.S.H. are not eligible.

First consideration will be given to original articles or reports of investigations published in one or other of the various medical journals.

Closing date for 1949 prize : December 31, 1949.

(3) PARKES MEMORIAL PRIZE.

Silver-gilt medal and the sum of approximately £30 awarded annually to the regular serving Officer of the Royal Navy or Army who, in the opinion of the Committee, has done most by professional work of outstanding merit to promote the study of Naval or Military Hygiene.

Officers on the staffs of the Naval Medical College, the R.A.M.College and A.S.H. are not eligible.

Closing date for 1949 prize : December 31, 1949.

(4) CONSULTANTS PRIZE.

The sum of approximately £30 for an Essay set by the Committee. The award is made for professional work and not for administrative work. The prize is open to Royal Army Medical Corps Officers holding a Regular or Short Service Commission. The author of the winning essay may be called upon to read his paper at the R.A.M. College at the discretion of the R.A.M.C. Prize Funds Committee.

The subject set by the Committee for 1949 is : An essay of not more than 10,000 words on " A military medical subject of importance in the Prevention, Investigation or Treatment of Disease or Injury in the Army."

Closing date for 1949 prize : December 31, 1949.

RETIREMENT OF MISS CUFFEY

THE following has been received from O.C., The Cambridge Hospital, Aldershot :

After twenty-one years' service Miss Cuffey is leaving the McGregor mess, Aldershot, where she has been employed as stewardess.

It is thought that many R.A.M.C. officers would like to subscribe to a testimonial for her.

Officers wishing to do so should forward their cheques to the P.M.C., The McGregor Mess, Aldershot, at an early date.

THE COLONEL-IN-CHIEF

THE following letters were exchanged between the D.G.A.M.S. and the Private Secretary to Her Majesty the Queen, our Colonel-in-Chief, on the occasion of His Majesty The King's recent operation :

38, Hyde Park Gate,
London, S.W.7.
14th March, 1949.

DEAR HARVEY,

Will you please convey to Her Majesty, our Colonel-in-Chief, from all members of the Army Medical Services, our sense of relief on hearing that the operation performed on His Majesty The King was successfully carried out.

We pray that the results of the operation will be beneficial in restoring His Majesty's health.

Yours sincerely,
Sgd. N. CANTLIE.

Major T. C. HARVEY, D.S.O.,
Private Secretary to Her Majesty The Queen,
Buckingham Palace, S.W.1.

BUCKINGHAM PALACE,

March 17th, 1949.

MY DEAR GENERAL,

I am commanded by Her Majesty The Queen to say how greatly she appreciated the most kind message which you have sent on behalf of the Army Medical Service.

The Queen was much touched by your good wishes and sympathetic consideration.

Yours sincerely,

Sgd. T. C. HARVEY,

Private Secretary to H.M. The Queen.

Lieut.-General N. CANTLIE, C.B., M.C., M.B., F.R.C.S., K.H.P.,

D.G.A.M.S.,

The War Office, S.W.1.

Obituary

Major-General JOHN WEIR WEST, C.B., C.M.G., C.B.E., K.H.S.

WE deeply regret to record the death of Major-General John Weir West which took place at Fleet, Hants, on March 6, 1949.

General West was a man of outstanding personality and character who was respected and loved by all who came into contact with him whether professionally—either as colleagues, pupils or patients—or socially. He was an honest man, free from guile or insincerity, in whom motives of self-interest were completely lacking. While he held definite opinions he was always ready to listen to others and was always one to encourage the younger members of the Corps.

It was the writer's good fortune to have him as a teacher of Military Surgery at the Royal Army Medical College and, later, to see more of his work while on the Staff at the Queen Alexandra Hospital, Millbank. As a lecturer he was clear, concise and relevant and his lectures were free from verbosity, ambiguities and woolliness. As a clinical teacher he was definite and patient and never lost sight of the fact that his patients were individuals in need of treatment.

His surgical opinions were invariably sound and his operating technique was much above the average. He had a pleasant human approach alike to patients and theatre staff from whom he expected—and got—a high standard of efficiency. His courtesy towards, and thoughtfulness for, those with whom he was working was never failing. It was a pleasure to be his anæsthetist to whom he never failed to speak a word of thanks at the end of an operation.

He did more than any one of his day and generation to raise the standard of surgery in the British Army.

He enjoyed the interlude during his period of administration in Burma where he did excellent work during a troubled period, but he was obviously happy to return to his work as a surgeon again.

Until recently he was a not-infrequent visitor in the Millbank Mess to which he came to attend meetings of the various committees in which he took an active interest. He was always delighted to see old friends. No matter how slightly one had known him, or how long since one had seen him, his greeting always contained the warmth of a true friendship.

In recent months he had been noticed to be failing but he made light of his infirmities and remained the courageous and cheerful gentleman he had always been.

A very great gentleman has gone from our midst.

MAJOR-GENERAL JOHN WEIR WEST

M.B. (R.U.I.) 1899 ; D.P.H. (R.C.P.S.I.) 1910 ; M.Ch. (Belfast) 1917 ; LL.D. (*Hon. Causa*) (Belfast) 1937.

C.B., *C.M.G.*, *C.B.E.*, K.H.S.

Queen's South African Medal and Clasp ; 1914 Star and Clasp, B.W. and V.M. ; Burma (1930-32) Medal and Clasp.

Legion of Honour, 5th Class ; Italian Public Health Silver Medal.

Action Service : South Africa 1901-1902, operations in Cape Colony and Orange River Colony. France and Belgium, August 1914 to November 1917. Italy, November 1917 to April 1919.

Professor of Military Surgery Royal Army Medical College, January 1, 1920, to April 30, 1924 ; A.D.M.S. Burma Independent District, 1930-1932 ; Consulting Surgeon to the British Army, March 1, 1932, to June 14, 1932.

Professor of Military Surgery R.A.M. College and Consulting Surgeon to the British Army, June 15, 1932, to his retirement on August 27, 1935.

After his retirement he held the post of House Governor, King Edward VII's Convalescent Home for Officers, Osborne, Isle of Wight.

For some time during the recent war he was Medical Superintendent of the Botley's Park War Hospital.

Colonel Commandant Royal Army Medical Corps, November 23, 1942, to August 27, 1945.

Lieutenant-General CANTLIE writes :

Johnnie West was surgical specialist at Millbank when I first met him thirty years ago. He had proved his ability as a surgeon in the war and then occupied the most coveted surgical job in the Corps—Specialist at Millbank and Professor of Surgery at the College.

I learnt to admire and respect him while I was under training in the wards and I shall never forget his delight when I was able to tell him I had passed my Final Fellowship. It was due largely to his generosity in allowing me to attend the Fellowship classes at the London Hospital that I was able to pass.

His extensive practical knowledge of both war surgery and peace surgery was of tremendous benefit to the young surgeons like myself who worked under him. He was

always ready to teach in the wards and in the theatre and his keenness was an inspiration.

Later on his ability brought him the important appointment of Consulting Surgeon and his experience and ability fitted him well for the post. By many he will be remembered for his period as House Governor of Osborne House where after his retirement from active surgery he still preserved that professional enthusiasm which characterized him.

As a man Johnnie West was immensely popular in his quiet way, and to his patients he was kind and sympathetic to a degree. As a surgeon he had the gentle touch both as a clinician and an operator. His thin ascetic face with his kindly smile and twinkling eyes will be remembered by many officers and by many patients who have cause to be grateful to a fine surgeon and a great gentleman.

Colonel JOHN WEDDELL writes :

I first met " Johnny West," as he was affectionately known to everybody, at Millbank, in 1921. He was then Professor of Military Surgery, lecturing at the Royal Army Medical College and doing Surgery at the Queen Alexandra Military Hospital. His lectures on War Surgery were of a very high standard based, as they were, on the experiences of others as recorded in the " Medical History of the War," and backed up by his own work as an operating surgeon. These lectures were worthy of a much wider audience. An indefatigable worker he was a keen and meticulous surgeon. He was kindness itself to his patients and nothing was too much trouble to him. He was respected and admired by our Civilian Consultants and by his many friends in the surgical world.

He was unique in that he was twice Consulting Surgeon and I should say that he did more than anyone to raise the standard of surgery and anæsthetics in the Army.

[The late Rowley Bristow once gave it as his considered opinion that Johnny West had done more than anyone else to raise the standard of surgery in the Army to its high level prior to the War of 1939.—ED.]

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Journal of the Royal Army Medical Corps.

Editorial

QUEEN ALEXANDRA'S ROYAL ARMY NURSING CORPS

A ROYAL WARRANT dated February 3, 1866, made provision for the appointment of female nurses to any Military *General* Hospital.

On April 21, 1902, a Royal Warrant established Queen Alexandra's Imperial Military Nursing Service.

On January 31, 1949, a Royal Warrant was issued, bringing into being Queen Alexandra's Royal Army Nursing Corps. It reads as follows:

GEORGE R.

WHEREAS WE deem it expedient to authorize with effect from 1st February, 1949, the formation of a corps to be entitled the "Queen Alexandra's Royal Army Nursing Corps."

OUR WILL AND PLEASURE IS that the Queen Alexandra's Royal Army Nursing Corps shall be deemed a Corps for the purposes of the Army Act, the Reserve Forces Act, 1882, and the Territorial and Reserve Forces Act, 1907;

OUR FURTHER WILL AND PLEASURE IS that the Schedule to the Warrant of His late Majesty King George V, dated 27th February, 1926, shall be amended as shewn in the Schedule attached to this our Warrant;

LASTLY, OUR WILL AND PLEASURE IS that the rates of pay and conditions of service at present provided for officers of the Queen Alexandra's Imperial Military Nursing Service shall be applied to officers of the Queen Alexandra's Royal Army Nursing Corps until our further Will and Pleasure be made known.

Given at Our Court at St. James's, this 31st day of January, 1949,
in the 13th year of Our Reign

By his Majesty's Command,
E. SHINWELL.

SCHEDULE

Under "OTHER BRANCHES" and next below "General Service Corps."

Column 1. Insert "Queen Alexandra's Royal Army Nursing Corps."

Column 2. Insert "all units and personnel of the Queen Alexandra's Royal Army Nursing Corps."

So there came into being on February 1, 1949, the Q.A.R.A.N.C.—just half a century later than the R.A.M.C.—a New Corps but built from well-tried material—the officers of the Q.A.I.M.N.S.

We do not propose to discuss the reasons lying behind this change. Suffice it to say that they are sufficient and we now have this completely new Corps with its officers and other ranks. We have become so accustomed to the sight of V.A.D.s and A.T.S. in hospital wards that the alteration in status will make no outward difference. When the initial period is over training arrangements should result in an even higher standard of nursing than at present.

The Q.A.R.A.N.C. has its own Depot which constitutes the Training, Holding and Drafting Unit of the Corps. As a temporary measure this is situated in Keogh Barracks, Mytchett, but it is hoped that by the end of 1949, the Depot will have moved to permanent accommodation at Ontario Barracks, Hindhead.

The former Q.A.I.M.N.S. Mess at Queen Alexandra Military Hospital, Millbank, has become the Headquarter Mess of the Q.A.R.A.N.C.—rules and regulations are being printed. This Mess is being run, in accordance with King's Regulations, on the same lines as other Headquarter Messes in the Army.

The officers of the Q.A.R.A.N.C. are King's Commissioned Officers within the Women's Forces and have adopted the rank titles hitherto used by the A.T.S., now applicable to all women officers.

These are:

Subaltern	equivalent to Lieutenant
Junior Commander	equivalent to Captain
Senior Commander	equivalent to Major
Chief Commander	equivalent to Lieutenant-Colonel
Controller	equivalent to Colonel
Senior Controller	equivalent to Brigadier
Chief Controller	equivalent to Major-General.

Officers will normally be addressed by their Army rank, except when they are in performance of their professional duties when they will be addressed by titles significant of their nursing appointments, e.g. "Sister" and "Matron."

The Colonel-in-Chief of the Q.A.R.A.N.C. is Her Majesty Queen Mary.

The Colonel Commandant is Dame Louisa Wilkinson, *C.B.E.*, *R.R.C.*

The Matron-in-Chief is Senior Controller Miss Anne Thompson, *C.B.E.*, *R.R.C.*

A committee is sitting to decide on the new uniform. The design has been agreed for the Women's Forces but, as the W.R.A.C. wished to wear green, it has been decided that the Q.A.R.A.N.C. should return to the familiar pre-war grey and scarlet. Many details have yet to be decided especially for ceremonial wear. The design will be the same for Other Ranks, with some slight modification in the uniform for ward wear. Here, for instance, Other Ranks will not wear the Red Cape which will now be worn by *all* officers as the Corps will consist solely of Regulars—permanent and short service—but the scarlet will be

incorporated in some way for the Other Ranks to demonstrate their inclusion in the Corps.

Other Ranks, Q.A.R.A.N.C. will be employed

(a) as a 10 per cent dilution of Other Ranks R.A.M.C., and

(b) on a 100 per cent basis for employment in women's wards, families' hospitals and for duty in Nursing Officers' Messes.

They will, as far as is possible and reasonable, live under comparable conditions to the Other Ranks, R.A.M.C.

There is every intention that, in the event of Active Service, the Q.A.R.A.N.C. Other Ranks shall accompany any unit in which there are Nursing Officers. In fact, it is possible that there would, in this case, be a more general employment of female Other Ranks to release men for service in those units in which it is not feasible to employ women. It is the intention that the Q.A.R.A.N.C. Other Ranks should augment, but not replace, our R.A.M.C. orderlies.

The widespread employment of V.A.D.s in the two recent wars and the more recent use of A.T.S. orderlies has emphasized the fact that untrained¹ women could be most profitably employed in many ways in hospitals, thus releasing men for more forward areas. Many of us will view the passing of the V.A.D. with nostalgic regret and it may not be out of place to pause for a moment to pay tribute to the excellent work so cheerfully and constantly done by them under all circumstances.

However, times have changed and it is felt that whether, as volunteers, or under the conditions of the National Service Act the inclusion of such women in an Army Corps must foster a degree of *esprit de corps* not possible when they are of a separate community.

Now, for the first time in history, the Nursing Service will be a complete entity in the Army sense. The officers, having for the first time their own Other Ranks, will more truly appreciate the full meaning of Officer Status. The rest of the Army will also, we feel, have a better understanding of a branch of the Medical Services which is rather an unopened book to many, in spite of having been in existence, in some form or other, since the days of the Crimea—the best part of a century.

It was recently stated in a contemporary journal that "There is no point in pretending that women in uniform are anything other than a symptom of the decay of our civilization." Be that as it may—and we do not accept the thesis—it is one of the signs of health in our community that the Army Nursing Service has gained this well-merited distinction.

It is a far cry from the "camp followers" of early campaigns to the commissioned officers of Queen Alexandra's Royal Army Nursing Corps but none welcome the lusty infant with greater pride and affection than the Officers and Other Ranks of the Royal Army Medical Corps.

¹Using the term "untrained" in the restricted military sense. Many such as masseuses and dispensers were technically highly trained.

Original Communications.

PEDUNCULATED GROWTH OF THE FAUCIAL TONSIL

BY

Major D. W. BELL, M.B., B.S.

Royal Army Medical Corps. Lecturer in Pathology, Royal Army Medical College

AND

Colonel W. A. D. DRUMMOND, O.B.E., F.R.C.S.

Of the Oto-laryngological Department, The Queen Alexandra Military Hospital

[Received January 31, 1949]

J. B., a youth aged 19 years, was referred to the Oto-laryngological Service on account of halitosis. No other symptoms were complained of and there was no history of tonsillitis or quinsy. There had been no operations performed on the adenoids or tonsils.

Oto-laryngological Examination.—Nose: A poor airway due to septal deviation. Mouth: dental hygiene good. Nasopharynx: nil of note. Pharynx: both tonsils are enlarged. From the upper and posterior aspect of the right tonsil a lobulated mass which arises from a broad base projects backwards and inwards behind the soft palate and uvula. In appearance it resembles tonsillar tissue but is paler in colour. From the crypts of both tonsils foul-smelling debris can be expressed. The pillars of the fauces are normal. Larynx and pyriform fossæ show no abnormality. Cervical lymph nodes: the jugulo-digastric nodes are enlarged on both sides.

On March 8, 1948, under general anaesthesia, the tonsils were dissected out with no difficulty. It was noted that the right tonsillar bed was more vascular than the left.

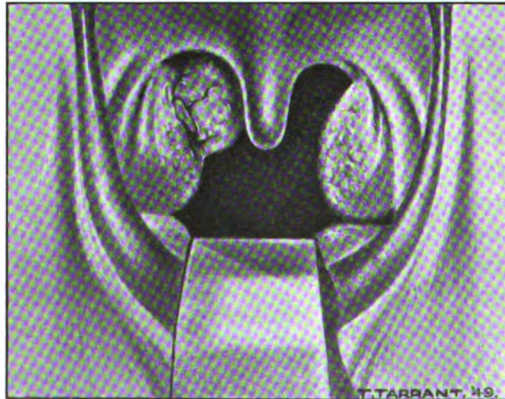


FIG. 1.—Drawing showing fauces, tonsils and pedunculated growth arising from the right tonsil.

Report of Pathologist (D. W. B.).—Macroscopic appearance—hardened specimen. Attached to the upper pole of the right tonsil by a short stout pedicle, 0.6 cm. diameter, there is a lobulated mass $1.8 \times 1.5 \times 1.3$ cm. It has a smooth greyish-white appearance

and shows numerous yellow patches up to 1.5 mm. diameter. On section the mass presents a white cut surface with a number of small peripheral cysts filled with yellow material.

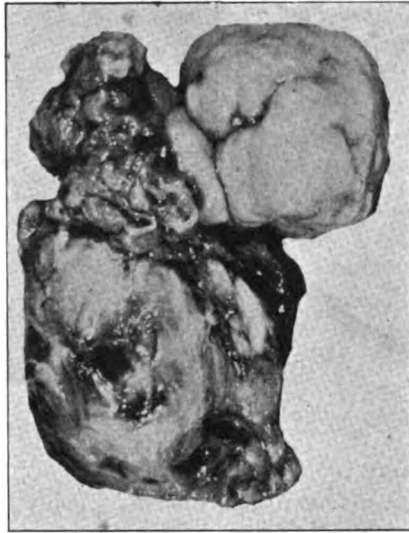


FIG. 2.—Photograph ($\times 2\frac{1}{2}$) of right tonsil and pedunculated growth.

Microscopic appearance: The short pedicle is formed of fibrous and lymphoid tissue there being no boundary between the substance of the tonsil and that of the growth which consists of tonsillar tissue.

The growth presents lymph follicles which in common with those of the tonsil show changes of reactive hyperplasia (Flemming's centres). Squamous epithelium covers the pedicle and also lines the crypts dipping into it. The crypts contain epithelial debris and pus cells. Strands of fibrous tissue run through the mass and beneath its epithelial covering.

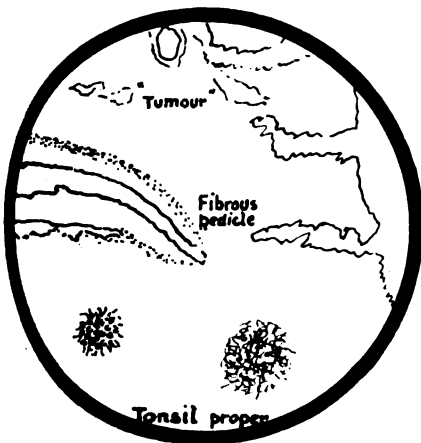


FIG. 3.—Descriptive diagram and photomicrograph of pedicle of growth. ($\times 90$.)

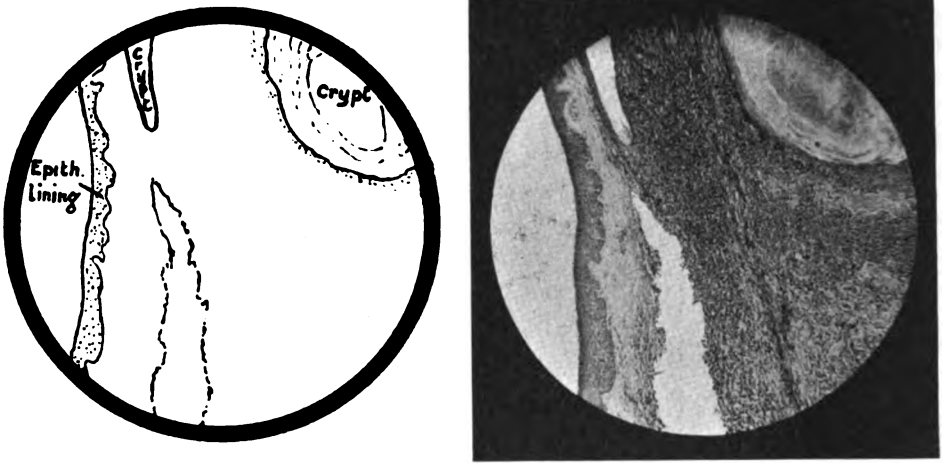


FIG. 4.—Descriptive diagram and photomicrograph of growth showing crypts. ($\times 90$.)

BENIGN growths arising from the faucial tonsils occur infrequently. Out of 8,516 pairs of diseased tonsils examined microscopically Starry (1939) found only two benign tonsillar growths. On account of the scarcity of material there is considerable disparity and confusion in nomenclature and classification.

It has been found that occasionally after tonsillectomy the lingual tonsil hypertrophies and may gain attachment to the tonsillar fossa. Such cases have been reported by New and Childrey (1931) in their review of 357 tumours of the tonsil and pharynx which were observed in the Mayo Clinic between 1917 and 1930 and by Laub (1942). Laub described a tonsillar polyp, measuring $5 \times 4 \times 3$ cm., which was attached by a pedicle, 1.5 cm. long by 0.75 cm. wide, to the lower aspect of the tonsillar niche and was probably connected with the lingual tonsil which had grown into the niche. These masses might be considered as compensatory hyperplasias rather than as growths of the tonsil.

In the past benign growths of the tonsil have been referred to as lymphomas but, although they are mainly composed of lymphoid tissue, they do not exhibit the characteristics of neoplasms. Unqualified, the term polyp is unsatisfactory as it may mean a mass composed mainly of lymphoid tissue or, as in the case quoted by Hanckel (1943), a vascular fibrous structure.

It is considered that for the type of growth described in this paper, the term "pedunculated growth" as used by Thomson and Negus (1948) is the most suitable.

Early reports of this type of lesion have been given by Froelich (1880) and Reinhard (1899). In the case quoted by Reinhard the growth arose from the upper and posterior aspect of the left tonsil and was considered to be a degenerated accessory tonsil. Pearlman and Pilot (1927) have given pathological reports on four cases of lymphoid tumours arising from crypts of the tonsil. The authors are of the opinion that they represent an unusual formation of hyperplastic lymphoid tissue rather than true new growths of the tonsil. New

and Childrey report a case in which the tonsillar tumour originated from the upper pole and was about 3 cm. in diameter. It was composed of hyperplastic tonsillar tissue and was considered to be due to the rupture of the tonsil with evagination of its substance.

Chisolm (1939) describes the case of a woman aged 64, who had a pedunculated growth arising from the centre of the right tonsil and extending beyond the mid-line. It presented a nodular non-ulcerated surface but beneath the epithelium there were a number of cysts containing yellowish material. The growth measured $2.5 \times 1.5 \times 1.0$ cm. In a second case this author reports a tremendous enlargement of the upper pole of the right tonsil which extended beyond the mid-line. The patient was a girl aged 4 years. On dissection the tonsil was found to be friable and no definite capsule could be demonstrated. The growth appeared to invade the muscle of the tonsillar bed. Microscopical examination showed large lymph follicles with very active germinal centres. The tonsillar crypts were extremely deep and some were found in a cross section as small islands of lymphoid tissue surrounded by stratified squamous epithelium towards the middle of the section giving almost the appearance of a papillomatous tumour.

Reeves (1945) describes a multiple lobulated polypoid mass arising from the right tonsil and measuring 4×2 cm. the lobules being separated by deep clefts. The mass was composed of lymphoid tissue.

COMMENT

The peduncular and lobulated tonsillar growth here described is typical of this tumour-like type of lesion and closely resembles in its main features those quoted in the literature.

The causation is at present uncertain but it has been suggested that the growth is due to the rupture of a hyperplastic tonsil with evagination of its lymphoid tissue.

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-

VENEREAL DISEASE AND THE WEST AFRICAN IN LONDON

BY

R. R. WILLCOX,

Hon. Lieutenant-Colonel, Royal Army Medical Corps

*Physician in charge: Venereal Diseases Department, King Edward VII Hospital, Windsor;
Senior Assistant Medical Officer, Venereal Diseases Department, St. Mary's Hospital, W.2;
One time Adviser in Venereology to the War Office and Command Venereologist West
African Command.*

THE prevalence of venereal diseases in the native West African is well known. Army figures published in the *Lancet* (1947) showed that the incidence in 1944 for the Gambia, Sierra Leone and the Gold Coast was on a rising scale of 120, 279 and 500 per thousand per annum for the three colonies respectively, while in Nigeria the figure was even more astronomical representing 625 per thousand for gonorrhœa alone. In 1944 the Army treated some 27,800 such cases in a military population of about 60,000 African troops though these included two, three or even four or more attacks in the same patient. The highest figures were encountered in the proximity of the larger towns.

Impressed by the promiscuity of the African in his homeland, and having a number of such under observation in London, I undertook a brief investigation to ascertain whether the West African in London had learnt any lessons in the avoidance of these diseases.

The group under review consists of 53 Africans who, apart from one from the Gambia, were born either on the Gold Coast or in Nigeria. Of 19 from the Gold Coast all were from the actual coast, there being one each from Cape Coast and Elmina and 17 from the capital at Accra. There were 33 Nigerians of whom no less than 27 were born at Lagos and there was one each from Arri, Calabar, Ondo, Onitsha, Owerri and Niger River. Their average age was 29·1 years (extremes 20–41) and, except for a handful of sailors and business men, the majority were students in this country: 17 had resided here for less than twelve months, 33 for less than two years, 38 for less than three and 15 for more than three years. The average stay in this country was thirty-four months. The duration that these patients had been continuously, periodically or occasionally under observation in the clinic was under a year in 23 (under six months in 14). 43 had been seen over a period of less than two years and 10 for longer than this time. The average potential observation period for the whole was approximately sixteen months.

These West Africans were contrasted with an equal number of consecutive white patients who attended for the first time sixteen months previously. The average age of the latter was 31·12 years (extremes 19–37). Routine Wassermann and Kahn tests were performed on the blood of all at the occasion of their first

visit and the cerebrospinal fluids of those patients showing a positive serology were examined when possible. A number of West Africans had blood slides and stools examined in addition.

REASONS FOR ATTENDANCE

When the West African attends the clinic he usually has something the matter with him: the European on the other hand is just as likely to have a non-venereal complaint or just be merely worried. The reasons for attendance of the two groups are depicted in Table I. It will be seen that 32, or 60·4 per cent, of the West Africans were suffering from syphilis or gonorrhœa in a communicable form whereas only half of this number (16 or 30·2 per cent) of the Europeans were so afflicted.

TABLE I

<i>Reason for attendance</i>					<i>West African</i>	<i>European</i>
Gonorrhœa ... ..	...	...	...	...	30	12
Syphilis early ... ..	...	...	...	...	1	2
late ... ..	...	...	...	...	1	1
Gonorrhœa and syphilis ... ..	...	...	...	...	1	2
Surveillance gonorrhœa ... ..	...	...	...	...	—	3
syphilis ... ..	...	...	...	...	2	4
<i>"N.V.D."</i>						
"Non-specific" urethritis ... ..	...	...	...	...	5	8
Penile sore ... ..	...	...	...	...	4	2
Balanitis ... ..	...	...	...	...	1	2
Skin rash ... ..	...	...	...	...	1	1
Stricture ... ..	...	...	...	...	1	1
Syphilis contact ... ..	...	...	...	...	1	—
Routine check: worried ... ..	...	...	...	...	2	6
Impaired fertility ... ..	...	...	...	...	1	1
Tired ... ..	...	...	...	...	1	—
Cough ... ..	...	...	...	...	1	—
Hernia ... ..	...	...	...	...	—	1
Scabies ... ..	...	...	...	...	—	1
Pediculosis ... ..	...	...	...	...	—	1
Paraphimosis ... ..	...	...	...	...	—	1
Epididymitis ... ..	...	...	...	...	—	1
Local pains ... ..	...	...	...	...	—	3
					53	53
					—	—

It must also be mentioned that further differentiation of the conditions included under the heading "non-specific" urethritis makes the distinction even more striking, for in the African this usually implies an obvious urethral discharge in which gonococci are not found but in the European a considerable proportion have urethral discharges which are seen only by the patient and may sometimes even be offered merely as an excuse to obtain the necessary routine check on account of deeper-seated worries.

As it may be objected that the European group is too restricted to serve as a

proper control, the annual figures for 1947 in the same clinic were consulted. These show that of over 3,000 new attendances that only 39·2 per cent were patients suffering from communicable infections of gonorrhœa or syphilis.

PREVIOUS HISTORY OF INFECTION

Of the Europeans 21 men had had 23 previous infections of which 7 were syphilis, 13 gonorrhœa and 3 "non-specific" urethritis. The West Africans far exceeded this number with no less than 43 infections in 36 men (32 gonorrhœa, 9 syphilis, 1 epididymitis and 1 bubo). 21 of the venereal incidents occurred in 16 men prior to arrival in this country and, indeed, this figure is probably higher.

REINFECTIONS WHILE UNDER OBSERVATION

The average possible period of observation for each group was sixteen months. 5 of the Europeans attended the clinic on subsequent occasions on account of six fresh infections. Four were gonorrhœa and two "non-specific" urethritis. Of the Africans, on the other hand, 10 Nigerians, 10 from the Gold Coast and the solitary Gambian, total 21, were able to acquire no less than 46 new venereal infections (36 gonorrhœa, 4 syphilis, 1 chancroid and 5 "non-specific" urethritis).

SERUM TESTS FOR SYPHILIS

As is well known West Africa is a yaws area, perhaps even the very fountain-head of the treponeme. Serum tests for syphilis, therefore, in persons from the Gold Coast, Southern Nigeria and other parts of the West African Coast are likely to be greatly confused by the possibility of yaws contracted in childhood. Juillard (1946), performing a battery of serum tests on 100 Senagalese troops stationed at Fez in French Morocco found that only 61 per cent had an entirely negative serology which, in 17 per cent, was strongly positive.

Willcox (1946) found that in 100 Gold Coast African troops attending his clinic at Accra, in whom early syphilis had been excluded by at least three negative dark-field tests on each case, that 51 per cent had a completely negative serology but that in 21 it was strongly positive to both the Kahn and the Ide, the only two tests that could be performed.

The results in the present series are shown in Table II.

TABLE II

	<i>West Africans</i> (53)	<i>Europeans</i> (53)
W.R. negative Kahn negative	29	44
W.R. doubtful Kahn negative	—	1
W.R. negative Kahn positive	3	3
W.R. doubtful Kahn positive	2	—
W.R. positive Kahn negative	—	1
W.R. positive Kahn positive	19	4

Of the 24 Africans with positive Kahn tests there was existing evidence of syphilis in 2, definite past evidence in 3, possible past evidence in 3 and 4 had

had previous gonorrhœa. Assuming the latter all had a double infection 12, or 50 per cent, still had no clinical or historical evidence of syphilis to support the serum findings. Four of these gave a history of yaws in childhood. One man, indeed, had a chronic ulceration and dermatitis of the legs with fissuring of the feet which responded like magic to treatment with bismuth and penicillin.

Of the 9 Europeans with non-negative bloods, the 4 which were strongly positive were proved syphilitics, 3 of the others were old known cases of syphilis but there were 2 patients with false positive Kahns and negative Wassermann reactions. Both of these proved negative to further tests, an event which was noted with only one of the Africans.

CEREBROSPINAL FLUID

Eleven of the West Africans with repeated positive serum tests had a cerebrospinal fluid examination. There were negative findings in 8. Of the 3 positives, a protein content of 60 mg. per cent and an excess of globulin with otherwise normal findings were noted in a man with syphilitic aortitis; a raised protein with a paretic gold sol curve and a raised globulin content in the fluid from a man known to have had syphilis twenty-four years previously; 50 lymphocytes per c.mm., a paretic Lange curve and a positive Wassermann but a normal protein content in the third known to have had secondary syphilis only eight months before.

In none of the patients tested in whom there was no present or historical evidence of syphilis was any abnormality detected in the cerebrospinal fluid.

RADIOGRAM OF THE HEART AND GREAT VESSELS

Fourteen of the West Africans showing positive serum tests for syphilis had an X-ray examination of the heart and great vessels. One known syphilitic showed definite aortic dilatation but the remainder were negative though 3 showed left ventricular enlargement associated with a raised blood pressure.

BLOOD SLIDE

A single blood slide was taken at 6 p.m. from 20 West Africans and no evidence of filariasis was found in these specimens.

STOOL EXAMINATION

A stool examination for ova indicative of helminthic infestations was performed on 29 of the West African patients. Four of these showed that they were carriers of *Trichuris trichiura* or *whipworm*. This worm, which is 40–50 mm. long, and three-fifths of which is thread-like, commonly lives in the cæcum or the large intestine. The characteristic ova, which are resistant to cold and drying, are shed in the stools. No intermediate host is necessary and direct transference to another human is achieved by food or water. Usually the worms cause no harm though occasionally they find their way to the appendix or may produce a severe anæmia.

It is not possible to state whether these parasites were brought from West

Africa or were acquired in this country for the 4 men had resided in the United Kingdom for nine, sixteen, fifty-three and sixty-four months respectively.

SUMMARY AND CONCLUSIONS

(1) Fifty-three West Africans of an average age of 29 years, who had been in this country for an average of thirty-four months have been studied in relation to previous venereal infections and reinfection. An equal number of Europeans have been used as a control. The details of the present infection, the serum reactions, cerebrospinal fluid findings and the results of radiological examinations of the heart and great vessels and examinations of blood slides and stools of the West Africans are discussed.

(2) 60·4 per cent of the West Africans, as compared with 30·2 per cent of the Europeans, were suffering from syphilis or gonorrhœa, or both, in a communicable form on the occasion of their first attendance at the clinic.

(3) The West Africans admitted to a history of 43 previous venereal infections which was nearly double the 23 infections previously contracted by the Europeans.

(4) Only 6 reinfections were noted in the 53 Europeans during the possible average sixteen months of observation. The West Africans, on the other hand, were able to acquire no less than 46 additional infections in the same time.

(5) Simultaneous Wassermann and Kahn tests performed on all showed 9 Europeans and no less than 24 Africans with a serology other than negative to both tests. At least 12 of the latter are believed to have been due to past infection with yaws.

(6) Eleven of the West Africans with a strongly positive serology had a lumbar puncture performed. Abnormal spinal fluids were found in 3. One of 14 who had radiological examination of the heart and great vessels showed signs of syphilitic aortitis.

(7) Twenty West Africans had blood smears examined for microfilariae with negative results. However, 4 of 29 patients who submitted to stool examination were found to be carriers of *Trichuris trichiura*. The average stay in this country for the 4 patients was three years and there was therefore no evidence as to where this infection was acquired.

(Thanks are expressed to Dr. W. Killpack for his kind examination of the stools.)

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IMPROVISATIONS

BY

W. R. MARTINE, O.B.E., T.D., M.D., D.P.H.

Late a/Colonel, Royal Army Medical Corps

It became apparent early in the days of the B.E.F. that ingenuity was required if an adequate supply of the basic sanitary appliances was to be assured. Just as men and fighting equipment were short of requirements, so was there a shortage of the labour and material necessary for the provision of ablution benches, latrines, field kitchens, etc. It became increasingly evident, moreover, that R.E. provision, owing to the diversity of demand made upon that hard-worked section of the Army, could never meet its obligations in full. I have even met the Garrison Engineer who would strenuously deny any such responsibility. Improvisation became, and remained, the only answer.

As a result, it seems inevitable that those whose duty it was to advise in such matters, should, in light of their knowledge, turn to and produce for themselves and for their neighbours. That such policy was wrong I have no doubt whatever, but it was the immediate answer to the problem. Hygiene workshops did a very great deal in this way and in six years I never found the workshops which did not welcome yet another job—for the sheer enjoyment of doing it.

It is to place on record, then, that ingenuity and resource of R.A.M.C. hygiene workshops' personnel that I have prepared this short paper, and I would ask those who served in North-West Europe, the Middle East and the Far East, to bear with me if I concentrate rather upon the North African and Italian theatres of operation. I refer in particular to the Field Hygiene Sections serving in Tunisia in 1942–43 and to the School of Hygiene in Italy, in 1944. It should be clearly understood, I think, that the need for improvisation of sanitary equipment was as great, if not indeed greater, in the Mediterranean theatre of operations between 1942 and 1944, as it had been in France in 1940, if only because shipping space was not so readily available and the countries concerned presented greater difficulties.

Following the allied landings in North Africa in the late autumn 1942, and the rapid thrust into Tunisia which followed, forward troops soon found themselves 500 miles from their supply base, with rail transport very highly disorganized, and ammunition, R.E. battle-stores and rations rightly claiming every priority of movement by road and rail.

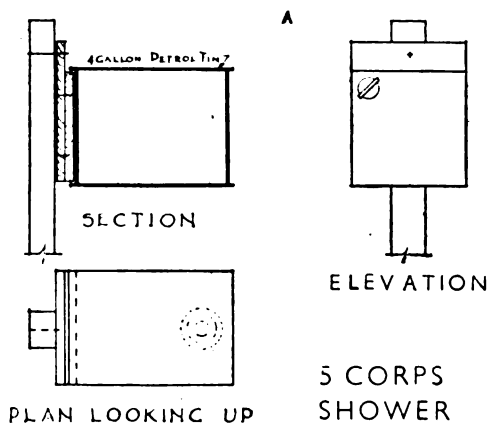
The essence of good improvisation is to make use of what may be available.

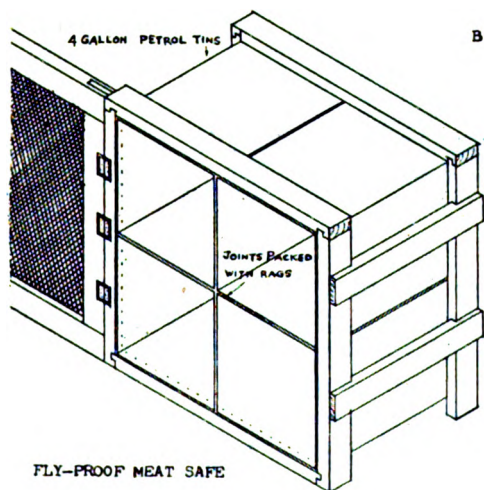
and it was not long before each successive railway station from Ghardimaou, close to the Algerian border, to Medjez el Bab was provided with bucket latrines and otway pits, ablution facilities and an incinerator. The flimsy non-returnable petrol tin, the 5-gallon oil-drum and the compo-ration box provided the material for all but the frames for the otway pit tops, and the legs of the ablution benches. The workshops of Field Hygiene Sections carried out this work, and their efforts did not stop at railway stations. Souk el Arba, the main rail-head at that stage, was adequately supplied with deep-trench latrines, and a central refuse dump for all units in the area was established. A Sanitary Assistant supervised the incineration of refuse by Arab labour who also flattened all incinerated tins which were subsequently used as bottoming in repair work on the Bone-Souk el Arba road, so much used for supplies in the later stages of the campaign.

Nor were forward troops neglected. Regimental pioneers came back with loads of compo-boxes and flimsies, and under the workshops' foreman's direction made quantities of fly-proof latrine-boxes as samples for each unit and sub-unit in the forward defended localities.

Shower-baths presented an early problem among Corps troops, who were located at too great a distance from the civilian installations at Souk el Arba and Beja, while mobile bath units had been very rightly allocated to more forward troops. A variety of types of improvised shower, therefore, made their appearance, the 5 Corps Shower (A and Aa), made from the returnable 4-gallon petrol tin, proving the most successful. This type can be slung from a tent pole or from the side of a truck, and is therefore preferable to the Tilt Shower (A), made from a 5-gallon oil-drum and requiring to be slung from the forked branches of a tree, or from two upright supports.

Again, as the fly season approached, and units began to realize the need for fly-proofing of opened foods, fly-proof meat-safes of a variety of types began to appear. The most interesting to my mind, and one which was extensively used in Tunisia, and later in Italy, was actually modelled from a diagram of a type used in the North Russian Expeditionary Force in 1919 (B). Here also

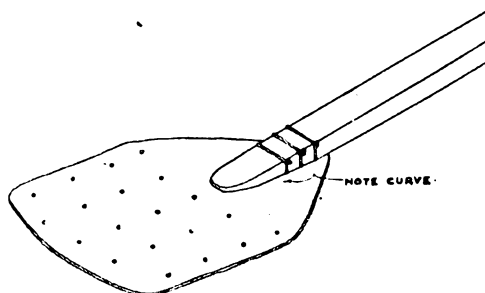




flimsies proved their salvage value. In the summer of 1943, anti-fly equipment was in typically short supply. It was natural, therefore, that improvised fly-swats were almost as common as the standard issue made of wire and gauze. One of these, evolved after the fall of Tunis and before the start of the Sicilian campaign, is worthy of notice—the Carthage Fly swat (C). This was widely

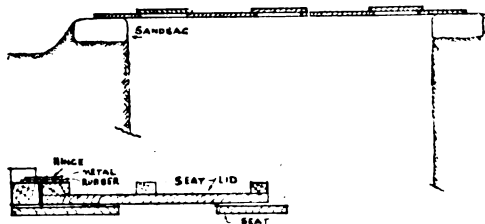
THE CARTHAGE FLY-SWAT

C



distributed through Army Group H.Q. near Carthage. It was easy enough to find the necessary piece of stick, rubber and wire, while a sharp knife, a pair of scissors and a pair of pliers were the only tools required.

Whereas in Tunisia the rock nature of the high ground and the dense clay of the valley made the deep-trench latrine unpopular, in Italy, on the other hand, direct deep disposal was more generally adopted. The greatest difficulty was limitation of transport, which prevented forward units from taking properly constructed latrine tops with them when they moved forward. A Battalion Commander in 4th (British) Division provided what was, I think, the answer—a 3-seater top with fly-proof lids, capable of being slung on the side of a 3-ton lorry. This type (D and Da) was, in fact, used in any situation forward other

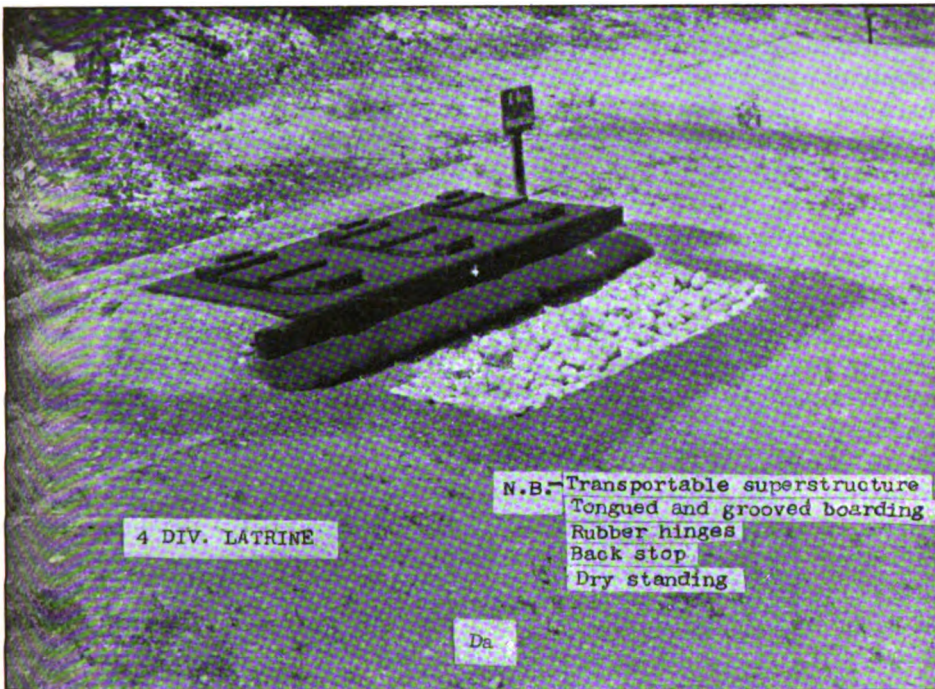


4 DIV LATRINE

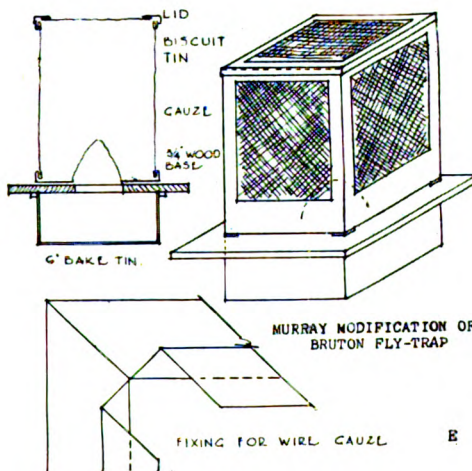
D

than the actual slit-trench, where a crawl-trench leading to a latrine trench behind seemed the best solution. This type had the distinct advantages of using little tongued and grooved boarding, and providing a suitably low seat.

So great was the need for improvisation in Italy that a monthly course of instruction for Regimental Pioneers at the School of Hygiene was usually filled to capacity. These men were given demonstrations on the model grounds and



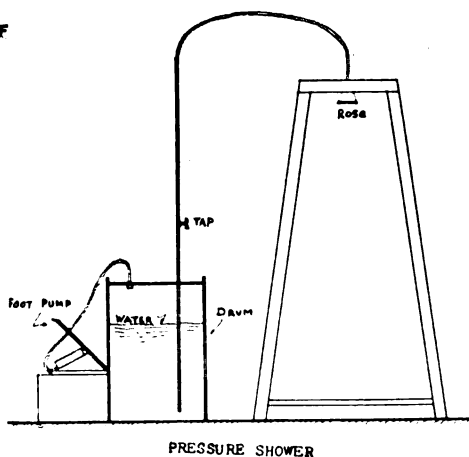
spent the rest of their time in workshops where they learnt to use the tools on charge to them in their units, in making improvisations such as they could turn out on their return. Materials for such classes might have been a serious problem, but as I have already said most troubles can be surmounted. Solder, of which my initial and only issue was 6 sticks, presented no problem. My foreman never had a stock of less than 18-24 sticks, obtained by blow lamp from salvaged ammunition tins. Timber and nails also were the subject of a monthly visit to the depot at the nearest port where crates were unloaded and

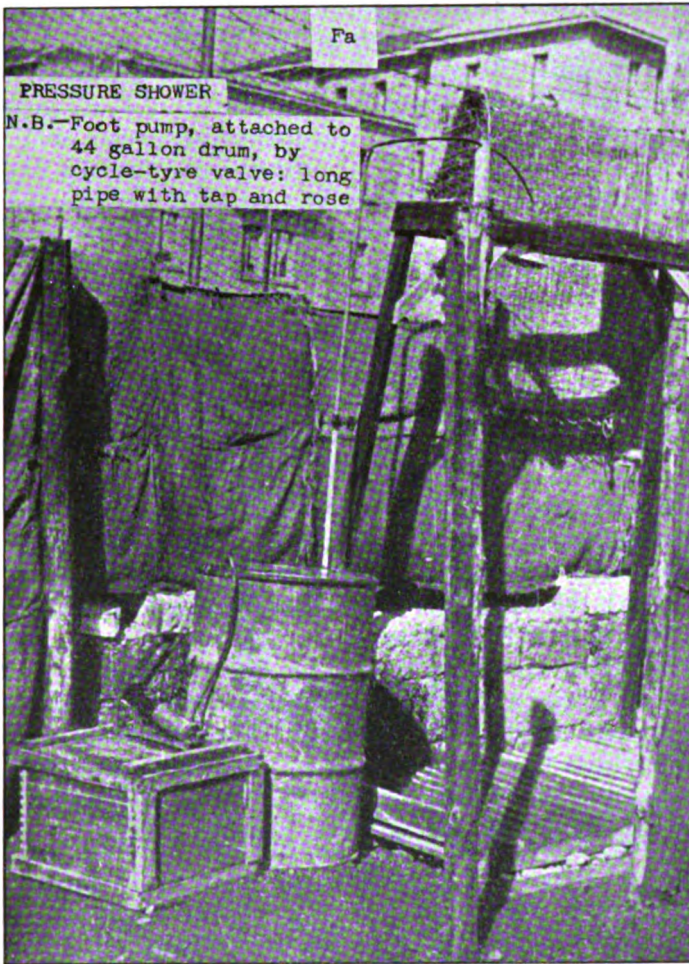


unpacked. Skilful dismantling by my own men provided an excellent source of salvaged timber of all dimensions, and in excellent condition, and a plentiful supply of nails as well. Without the C.R.E.'s co-operation, of course, we might have had to pack up; we should certainly have been unable to run the Improvisation Course, and provide all schools in the Central Mediterranean Training Centre with meat-safes, refuse-bin lids, fly-swats, fly-traps, etc., as we did during 1944.

In the summer of 1944 we were much occupied in finding the best type of fly-trap for the theatre. This proved to be a modification (E) of the Bruton Fly-trap of the Middle East, suggested and elaborated by my Sergeant-Major Instructor—then W.O.II G. Murray. Experience showed that these gave best results when sited in batteries of three, the first baited on Monday, the second on Wednesday and the third on Friday in each week. With the bait-tins numbered, it was easy to ensure that one in each battery was sufficiently "high" to attract all flies in the vicinity. Each bait was always left for seven days, and if necessary, moistened with water and stirred up each morning. Any food scraps, except onion, proved suitable, and it interested me to notice that the unpopular "soya-link" did not have to be decomposing! Traps were covered over at night, or taken indoors, as a precaution against stray dogs. The number of fly larvæ to be seen in the bait-tin by the end of a week left no doubt in the mind of that individual who had always been sceptical about flies breeding in kitchen refuse. Our problem was rather in persuading him that the thousands of dead flies and the week-old bait were best disposed of by incineration.

When the School of Hygiene first opened in Italy, I was faced with the problem of 100 other rank students and very limited bathing facilities which had to be shared with a number of other schools. There was no open-air bathing available either. It was decided, therefore, to erect a bath-house in brick with concrete floor, drained to a sump and providing two showers, hot or cold, with enough water storage for 30 men. All the materials except cement came from salvage and took some time to collect. To fill the gap, therefore, my workshops' foreman produced a Pressure-shower apparatus (F and Fa) capable

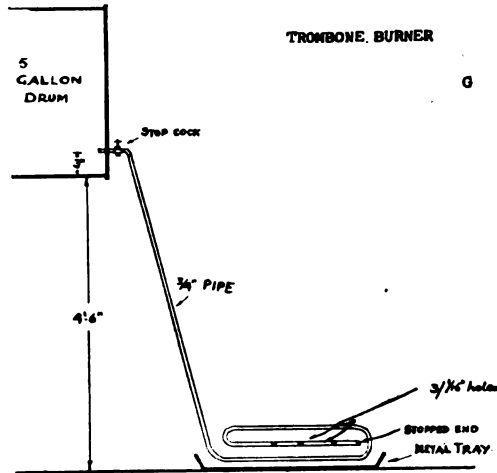




of giving 15 men a reasonable shower-bath for each refill. This was constructed entirely from salvage, even the foot-pump shown in the photograph being produced from two separate unserviceable pumps found on a salvage-dump. This improvisation proved to be so successful that I had a number of small ones made out of 5-gallon drums.

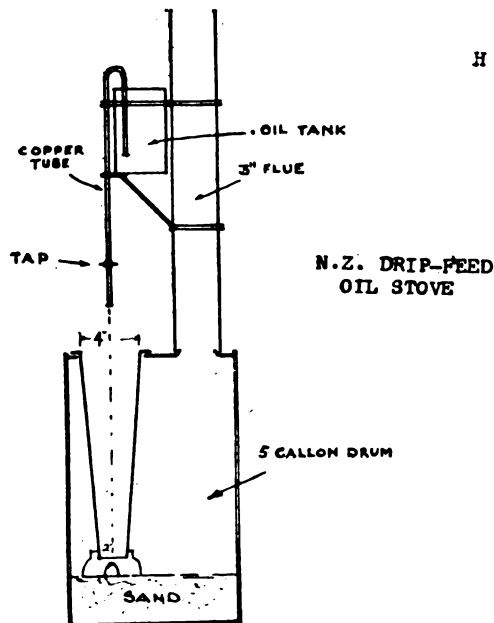
As the autumn drifted into the colder weather of early winter, the fuel-shortage became apparent and means of cooking and space-heating became the problem of the day. The oil and water-flash fire, proved most efficient in skilled intelligent hands, using the correct type of 3-tier burner, adequately serviced, and it is unfortunate that the good work of Clay and Evans at Mytchett, and Brown, Stent and Peel in Italy should not have had more widespread good results.

The Trombone Burner (G), and the Bazooka, however, were simpler of manufacture, and by the winter of 1944 had been generally adopted for field



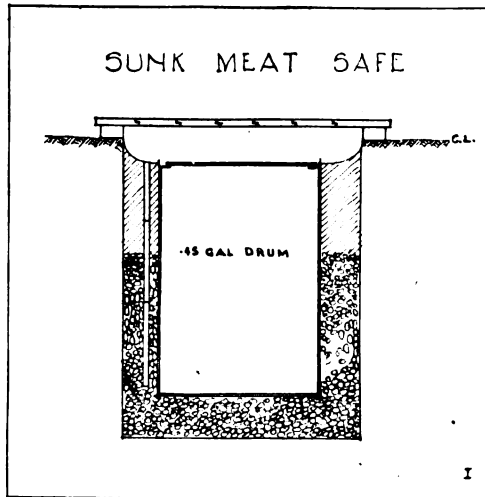
cookers, for 72 in. ranges, and for boilers designed to burn solid fuel. The maintenance—i.e. cleaning the tray below the burner, regular “pricking” of the jet-holes, and the careful exclusion of water from the filtered sump-oil which was so much used with this apparatus—was relatively simple and the burner gave little trouble even in unskilled hands.

Where this method could not be used for space heating, i.e. in the hospital under canvas or where a central heating installation did not exist, many different types were tried. The Canadian slow-combustion stove, using a 44-gallon drum with a layer of dried sand in the bottom, and burning 1 quart of filtered sump-oil in four hours, did not catch on as one had hoped. It soon gave way, in fact, to a drip-feed oil-stove, burning paraffin or a mixture of



paraffin and derve, which had been invented by a medical unit of 4th N.Z. Division (H). A 5-gallon drum is used in this stove, giving out real heat in a few minutes and requiring virtually no maintenance. The important factor is that the flue should be 3 in. or $3\frac{1}{4}$ in. in diameter, if adequate draught is to be obtained. This stove was extensively used in hospital tentage in 4th N.Z. Division—and without any accident.

The usual problem of keeping meat, etc., in the summer months occurred in both North Africa and Italy and the Sunk meat-safe, with or without some cooling device, was commonly used. I show here (I) a type which proved to be



satisfactory. The drum rests on stones in a pit, is surrounded by stones in the lower half, and water as required can be run down an improvised pipe at the side of the drum where ice is not available. The soil being, predominantly, clay, seepage was slow and topping up with water once daily was normally sufficient, provided a shaded site could be found. The following table shows temperatures for a site in the centre of the model-ground at the School of Hygiene in Italy, exposed to sunlight during the hottest hours of the day. Double summer time was in force.

EXPERIMENT I		SUNKEN MEAT SAFE		AUGUST 23, 1944
Hour of reading	External Temp.	Temp. bet. cover and lid	Temp. inside safe	Remarks
0900	96°	77°	72.5°	No wind
1000	103°	79°	73.5°	No wind
1100	118°	80.5°	74.3°	No wind
1200	104°	86°	74.3°	Very windy
1300	102°	88°	73.4°	Very windy
1400	93°	86°	77°	Wind and shade
1500	94°	88°	79°	Wind and shade
1600	94°	88°	77°	Wind and shade
1630	93°	86°	76°	Wind and shade

N.B.—All thermometer readings are Fahrenheit.

The difference in temperatures during the hottest hours of the day in what was admittedly a bad site justify the improvisation.

Many other improvisations could be mentioned, for much exhaustive trial and experiment occupied my team's available time. I have at least referred to a representative selection of successes. There were undoubtedly failures too which could not stand up to the rigorous test of use in the field by units not hygiene-trained, but such a test is, in my view, the only true test of an improvisation—that it should be successful in unskilled hands under active service conditions overseas.

It remains for me now to acknowledge first the encouragement received from a succession of D.D.sM.S., from Colonel T. Young, *O.B.E.*, *M.C.*, *D.D.H.* Allied Headquarters, *B.N.A.F.*, and later *C.M.F.*, and from Hygiene Officers who served under me, and secondly the enthusiasm and support of all other ranks in particular of *W.O.II* (now *W.O.I*) G. Murray, *M.B.E.*, to whom above all others I am indebted for being able to give this paper.

STREPTOMYCIN IN THE TREATMENT OF CASES OF TUBERCULOUS MENINGITIS IN THE ARMY¹

BY

Captain EDWIN S. CLARKE
Royal Army Medical Corps

INTRODUCTION

SINCE the days of remote antiquity, tuberculosis has been a scourge of man, and its treatment has been one of the major problems of the physician. But now, for the first time in the history of medicine, we have a substance that has been shown to influence favourably the course of tuberculosis in man. This drug is streptomycin and it is a product of the actinomycete, *Streptomyces griseus* being first isolated by Waksman and his co-workers in January 1944 [1]. In November of the same year [2] it was shown to inhibit the growth of *Mycobacterium tuberculosis in vitro*. Shortly afterwards, Feldman and Hinshaw [3] at the Mayo Clinic, applied the drug to tuberculous guinea-pigs with favourable results and they also demonstrated its good effect on certain types of human tuberculosis. These observations were quickly followed by intense experimental and clinical studies which are still in progress in many countries.

Of all the various types of tuberculous infections in man, the two that have resisted all forms of therapy and which have proved almost uniformly fatal are tuberculous meningitis and acute miliary tuberculosis (with or without meningeal spread). It is thus intensely gratifying to find that at last we have in our hands a drug which alters the course of these diseases. Streptomycin has been widely used in the last two years in the treatment of tuberculous meningitis and miliary tuberculosis, and although it is a little early to assess the results, it is generally thought that one-quarter to one-third of the treated cases of tuberculous meningitis have survived six to twelve months after treatment and the majority of these show no demonstrable signs of the disease: similarly with miliary tuberculosis a considerable number that have been treated with streptomycin are free from clinical, laboratory and X-ray signs of the disease six to twelve months after completing treatment.

Streptomycin became available in this country towards the end of 1946 (although a very impure product had been used by Cairns [4] prior to this) and in March 1947 our first case of tuberculous meningitis began treatment. Since then—a period of seventeen months—we have had a further 8 cases. Of these 9, 4 have died; 2 have made, what appears at the moment to be, full recovery and 3 are still undergoing treatment; among these latter, one is doing very well,

¹A Paper read at Military Hospital, Head Injuries, Wheatley, Oxford, on August 5, 1948.

one is making very slow progress and the other is practically unchanged.

At all times, these cases have been under the supervision of Sir Hugh Cairns and his assistants, and several have received part of their treatment in the Nuffield Department of Surgery, Radcliffe Infirmary, Oxford. In their report to the Medical Research Council, Smith, Vollum and Cairns [5] describe the results of treating 18 cases of tuberculous meningitis with streptomycin and the first 5 of our cases are included.

The treatment of tuberculous meningitis with streptomycin is a complicated and difficult task which can only be handled adequately by a trained team of skilled medical and nursing officers and orderlies, with close collaboration with the departments of pathology, radiology and otolaryngology. As will be emphasized later, it is important that this unit should be static so that each member can become highly proficient at his own task.

THE ACTION OF STREPTOMYCIN

Streptomycin has been shown to be effective against the tubercle bacillus and also several Gram-negative organisms. Its antibacterial efficiency against the former is amazingly high as compared with other antagonistic agents. By treating tuberculous animals, it is found that the disease process, which is characterized by advancing destruction, can be converted into regression and arrest with fibrosis, hyalinization and calcification of individual lesions. It appears that the major influence on the tubercle bacillus is one of suppression of the normal pathogenic activities, that is, it has a bacteriostatic action; recently, a bacteriocidal action has also been shown to exist [6], so that streptomycin behaves much like penicillin.

But unfortunately in tuberculous meningitis there are complicating factors which modify and interfere with the action of streptomycin. As with tuberculosis elsewhere in the body, the tubercle bacillus can hide in the centre of a caseating tubercle and because of the avascularity of this lesion, no matter how high the streptomycin level in the cerebrospinal fluid or blood is raised, they can still flourish unaffected and if the tubercle does not heal completely, there is always the danger of the organisms bursting through into the subarachnoid space. One of the means by which this could be combated would be to instigate treatment with streptomycin as early as possible in the disease so that these foci may be restricted in number and size. The formation of exudate and adhesions around the base of the brain is a prominent feature of the pathological picture and it frequently renders streptomycin therapy ineffective. Vascular thromboses play an important part in the production of the various clinical pictures seen in cases of tuberculous meningitis and these develop when the blood vessels are engulfed in exudate, and tubercles form close to their walls. In the untreated case, they are usually pre-terminal events and it is the object of streptomycin therapy to prevent them occurring and it is given a much better chance of doing so if the drug is introduced into the infected areas at an early date. Another result of exudate and adhesion formation in the basal cisterns is a blocking of the cerebrospinal fluid pathway so that an internal hydrocephalus

gradually develops and once it is established the prognosis is much poorer, for the patient dies of increased intracranial pressure.

It is thus of great value to begin the treatment with streptomycin in the early stages of the disease so that the tuberculous processes are combated and permanent damage prevented.

THE DOSAGE OF STREPTOMYCIN

Amounts of streptomycin are measured in units of pure base, one unit being equivalent to 1 microgram, so that 1 mg. corresponds to 1,000 units.

The dose of streptomycin is still an experimental subject, but it has been shown *in vitro* that most strains of *Mycobacterium tuberculosis* are inhibited by levels of $\frac{1}{8}$ to $\frac{1}{2}$ unit of streptomycin per c.c. Each case, however, requires individual consideration and at the moment no fixed rules for dosage can be given. All of our cases have been treated with a combination of intramuscular and intrathecal streptomycin.

(1) *Intramuscular*.—The intramuscular dose that we have used is 2 gm. per twenty-four hours and if this is given six-hourly satisfactory blood concentrations can be secured and maintained. After three or four months of this dosage and if the case is progressing satisfactorily, the injections are cut down to 2 daily, i.e. 1 gm. twelve-hourly. As the actual injection is quite painful—much of this probably being due to impurities—the reduction in the number of doses is welcomed by the patient and helps to raise his morale. Later, the drug can be further spaced so that one dose is given every twenty-four hours (2 gm.) and then 2 gm. every other day. The most difficult problem, is to decide when the streptomycin therapy can be safely stopped, but usually the intramuscular dosage is kept up for six to eight months and the actual date of stopping carefully determined in each case. If the patient is showing maintained objective and subjective improvement, if pyrexia is absent, if the B.S.R. is normal and if the cerebrospinal fluid cells and protein are decreasing, it is thought possible to stop all therapy. We have been probably more cautious here than elsewhere and the courses of treatment are usually longer. The results obtained by the Oxford unit would tend to justify this conservatism.

(2) *Intrathecal*.—Unlike penicillin, streptomycin passes through the blood brain barrier and finds its way into the cerebrospinal fluid so that the usual intramuscular dose can produce a level of 0.5 unit per c.c. in the non-meningitis case. But when meningitis is present, the amount of streptomycin passing into the cerebrospinal fluid increases and continues to do so as the disease progresses. This was graphically demonstrated by Cathie [7] while treating a case of miliary tuberculosis where initially there was no evidence of meningeal spread. Streptomycin was given by the intramuscular route only and while this treatment was in progress routine cerebrospinal fluid examinations revealed that the meninges had become involved. Almost immediately there was a rapid increase in the streptomycin present in the cerebrospinal fluid and the level rose to many times its previous figure. Thus the increased passage of streptomycin into the cerebrospinal fluid is a reliable sign of meningeal irritation; it is also possible that as

the inflammation subsides and the content in the cerebrospinal fluid falls, that this will be a guide to the progress of the disease.

Despite the fact that levels of streptomycin in the cerebrospinal fluid obtained by intramuscular injection alone, are *in vitro* detrimental to the tubercle bacillus, practical experience has shown that such treatment in a case of tuberculous meningitis is inadequate. On several occasions, it has been obvious that the intramuscular drug alone would not eliminate the tubercle bacillus from the cerebrospinal fluid. Cases that have had a short course of intrathecal streptomycin (in one case it was only two weeks and for technical reasons it was stopped) plus intramuscular and then intramuscular alone, have relapsed when the latter has been terminated and these relapses have usually proved fatal.

Thus all our cases have been treated with both intrathecal and intramuscular streptomycin, the intrathecal route being used for six to eight weeks. The intrathecal dose of 0.1 gm. (10,000 units) is given daily by lumbar puncture and twenty-four hours later it is found that the concentration is still 5 to 20 units per c.c. in the lumbar fluid and this appears adequate in most cases. The duration of the intrathecal therapy is another difficult problem and each case must be assessed individually. All of the surviving cases have had at least two months of this treatment.

This treatment means a lumbar puncture every day for six to eight weeks, and then twice a week until all therapy is stopped—another four to six months—so that the cerebrospinal fluid levels of streptomycin can be observed and also the changes in the cytology and biochemistry. The technical difficulties can be well appreciated and this part of the treatment imposes considerable strain on all concerned. Fortunately, the patient has a lengthy amnesia for the acute stage of his illness, but nevertheless his lot is a pitiable one. However, this therapy seems a little less barbaric and certainly achieves better results than the therapeutic measures in vogue one hundred years ago when blood-letting, purging with croton oil and calomel, violent emetics, blisters to the back of the neck and the pouring of ice-cold water over the shaven head were advocated.

It is important that the same person should do all the lumbar punctures and thus the importance of a static unit is obvious; the operator should be as familiar with the lumbar interspaces as with the back of his hand and the orderly must know just how to hold the patient, so that the procedure is performed as quickly as possible and with as little pain as possible.

Occasionally, a spinal block develops due to local trauma, direct irritation of the meninges and nerve roots by the streptomycin and an extension of the tuberculous process to the spinal theca. In these cases the intrathecal dose of streptomycin must be administered directly into the lateral ventricles, usually by way of frontal burrholes; the dose given is a little smaller, 0.075 gm. (75,000 units). One of our cases developed a complete spinal block and autopsy showed that the spinal subarachnoid space was full of tuberculous caseation and adhesions. In this case, the spinal theca did not un-block but usually if lumbar punctures are stopped for a few weeks, the block disappears and lumbar injections can be recommenced. The cisternal route has not been employed.

There is one other method used in the administration of streptomycin and this is described by Smith *et al.* [5]. The principal site of the disease is centred around the base of the brain, and it is here where most of the damage is done. It would therefore seem important to produce a higher concentration of streptomycin in this region and this can be done by introducing plastic tubes directly into the interpeduncular space, via a frontal bone flap, and injecting streptomycin down them at regular intervals as long as they remain in position and patent, which is usually one or two weeks. This procedure was performed in one of our cases but the disease, although temporarily improved, terminated fatally; the disease process was well under way when the intubation was done and the streptomycin did not influence it. In another case, it was attempted but had to be abandoned. As an early measure and more particularly in children, this additional route may be of some value.

THE CEREBROSPINAL FLUID IN TUBERCULOUS MENINGITIS TREATED WITH STREPTOMYCIN

The cerebrospinal fluid removed daily, prior to the injection of the streptomycin, and the specimens collected twice weekly when the patient is having intramuscular streptomycin, alone, are examined for the acid-fast bacilli (by smear and culture) and cells, protein, and chlorides and the concentration of streptomycin are estimated; as streptomycin is itself a reducing agent, the sugar content of the cerebrospinal fluid, while the drug is being given, is valueless. Again, it is important to have the same persons doing these investigations so that the individual experimental error will be constant throughout.

Interpretation of the cerebrospinal fluid findings is complicated by the fact that the streptomycin itself produces a certain amount of change, principally an increase in cells and a slight increase in protein. It was at first thought that this was due to contaminating impurities but even using a highly purified product, the cellular response and protein increase are obtained. Care must therefore be taken when assessing the day by day cerebrospinal fluid changes, but a general rise or fall in cells and protein gives a rough indication of deterioration or improvement.

STREPTOMYCIN RESISTANCE

This is one of the most serious obstacles to the achievement of therapeutic benefits from streptomycin in clinical tuberculosis. In a given population of tubercle bacilli, most of the organisms are sensitive to streptomycin, but there are usually a few variants present that resist the action of the drug, and these flourish when the others are absent, so that if treatment is continued long enough—and it always is lengthy in streptomycin-treated tuberculosis—the bacterial population is reversed so that now the individual members are predominantly resistant to streptomycin. The degree of resistance may be as much as a thousand times as great as that of a tubercle bacillus sensitive to streptomycin [8]. This has occasionally been demonstrated in cases that died during treatment, the tubercle bacillus isolated at autopsy being up to one thousand times as resistant as the organism isolated originally from the cerebrospinal fluid.

In meningeal tuberculosis, this event, for some reason, is rare as compared with its incidence in tuberculosis elsewhere in the body treated with streptomycin and the drug-resistant strains are rarely met with. Tubercle bacilli found in the meningeal tubercles of the unsuccessfully treated patients, frequently have the same *in vitro* sensitivity as the bacillus that was found initially and upon which the diagnosis had been made. In one case that had been treated for seven months, there was no change in the organism's sensitivity.

It is interesting to speculate upon the peculiarly dangerous source of infection presented by streptomycin-resistant strains of the tubercle bacillus from uncured patients.

THE TOXICITY OF STREPTOMYCIN

Streptomycin is more toxic than penicillin and, although all of our cases have shown some manifestation of toxicity, these have not interfered at all with the course of treatment. Toxic reactions may be divided into four groups:

- (1) The so-called histamine reaction.
- (2) Anaphylactic reaction.
- (3) Disturbances of vestibular and auditory functions.
- (4) Irritation of the kidney.

Originally many of these events were blamed on impurities in the drug but Farrington [9] using a highly purified product "at least 95 per cent pure" records all of them in a survey of human subjects given a four-months' course of treatment.

(1) *Histamine Reaction*.—We have occasionally witnessed this type of reaction, particularly in the case that was treated with daily intraventricular doses, but it has never proved a serious drawback. Flushing, headache and abrupt fall in blood pressure are its main features.

(2) *Anaphylactic Reaction*.—Some form of this has been observed in all the cases. It is characterized by rise in temperature, nausea and vomiting, maculopapular rash, hypotension and eosinophilia. In the case of the pyrexia, it is very difficult to know how much is due to the drug and how much is due to the tuberculous disease. The nausea and vomiting has appeared in all of the cases at some stage and in a few it proved a very troublesome feature, rapidly increasing the cachexia which is typical of the untreated disease. This was shown particularly well in one of the cases that recovered; he vomited persistently throughout the course of the treatment (both intrathecal and intramuscular) and put on no weight until the drug was stopped. He then stopped vomiting and his weight chart showed a steady rise. A rash appeared in one of the fatal cases and lasted several weeks; it gradually disappeared without treatment and did not appear to inconvenience the man. Eosinophilia and hypotension have not been observed in this series.

(3) *Disturbances of vestibular and auditory functions*, have occurred in all the cases that we have been able to investigate, and are characteristically a complete loss of vestibular function and a high-tone deafness.

Some of the patients have complained of vertigo while under treatment, but this may well be due to the tuberculous meningitis itself. In all cases that were

capable of adequate co-operation, we have demonstrated the complete loss of vestibular functions by means of the Hallpike method of calorics. The ear drums are stimulated with cold water in turn and the subjective and objective results observed. Normally the patient soon complains of violent vertigo, and lateral nystagmus is observed; in cases that have had streptomycin for a few weeks these phenomena were both absent. Usually the patient is demented and unco-operative for the first few weeks, or months in some cases, and it has not been possible to make accurate determinations of the exact stage in the treatment when the vestibular apparatus is affected. However, recently we have had a man who was rational enough in the early phases of his illness to have regular calorics performed. We were able to show that the vestibular response disappears between the seventeenth and twenty-first day of treatment; this corresponds exactly with the results of Farrington. Even after the streptomycin course had been stopped, this defect remains and this is so in both our successfully treated cases, who have now been without treatment for seven and eight months respectively. However, these two men are not inconvenienced by this, and apart from very occasional unsteadiness, are able to compensate fully for the loss.

In conjunction with this toxic effect, there is also involvement of the auditory apparatus in cases where streptomycin is given for prolonged periods. This is manifested by a falling off in the perception of high tones, as recorded by audiometric measurements. This has also occurred in all of the cases that we have been able to test, but an audiogram reading demands even more co-operation than a calorogram. In the patient mentioned before, who showed no marked mental changes, regular audiograms were done and we found that it was only after thirty-five days of streptomycin treatment that the deafness could be definitely recorded. This also persists after finishing the treatment, and audiograms of the 2 cases mentioned above, seven and eight months after stopping streptomycin, are substantially the same as when undergoing treatment. This, however, causes no incapacity as the hearing loss is above the range of conversational tones and indeed can only be picked up by careful audiometry. We have seen no gross hearing defect resulting from streptomycin administration.

Tremors of the hands have been observed in some cases and also a mild ataxia of the arms. These have been attributed to the streptomycin but they have also been described in untreated cases.

(4) *Irritation of the kidney* has not been an outstanding event in any of the cases, although one had a purulent cystitis which resisted all therapy, the organisms responsible being no doubt soon resistant to streptomycin. A small amount of albumin and a few casts have occasionally appeared in the urine but there has never been any evidence of gross renal damage.

Bulimia and arterial hypertension have been observed, but these would appear to be related to hypothalamic disturbances and their connexion with streptomycin therapy is not clear. Agranulocytosis mentioned by McDermott [10] has not been seen, despite a regular white cell count in all cases.

Skin reactions recently described in those that handle streptomycin [11], such as nurses, have not occurred, although it has been impossible to follow all of these persons for more than a few months. However, there seems to be little reason why the nurse should be contaminated at all if reasonable care is taken when injections of the drug are being handled.

Thus the toxic effects of streptomycin are relatively mild when compared with the ravages of tuberculous meningitis itself and now the general opinion is that the treatment should be continued despite their occurrence, for if it is terminated too soon, relapses always occur with usually fatal results.

In addition, it is important when attempting to evaluate the toxic manifestations and differentiate them from the signs and symptoms of the disease process itself, to have a clear impression of all the various forms that the latter may adopt. There is no better method of obtaining this knowledge than by studying some of the classical descriptions of tuberculous meningitis that were written in the eighteenth and nineteenth centuries when antemortem diagnosis depended upon the signs and symptoms. No doubt some of the cases were confused with other affections of the central nervous system but the clinical pictures of the true cases were accurate enough as they all died and were usually verified at autopsy by the characteristic gross appearances.

Thus three of our cases in the acute stages of their illnesses would complain bitterly of their beds being moved or that they were about to fall out of bed. This was at first associated with the vertigo due to the influence of streptomycin on the vestibular apparatus but Davis [12] describes exactly similar symptoms in some of his patients in 1840.

Further information regarding the toxic reactions of streptomycin is being collected from observing non-meningitis cases of tuberculosis undergoing streptomycin therapy.

ANALYSIS OF CASES IN THIS SERIES

Six cases of tuberculous meningitis have been treated and of these two have survived. Three others are still undergoing treatment.

(1) *The Survivals:*

Case 1.—The first was a soldier aged 22 years who presented with miliary tuberculosis and meningeal involvement. He began treatment on the fifth day of his meningitis and the forty-second day of general symptoms and altogether he had 523.63 grm. of streptomycin: 510 grm. by intramuscular route spread over 255 days and 13.63 grm. intrathecally given over a period of 140 days. Altogether, his course lasted 255 days (eight-and-a-half months), the longest of any, his illness being a protracted one and for several months he was quite demented. But now, nine months after stopping all therapy, he is perfectly normal apart from the absent caloric responses and low tone deafness discussed above. He has an amnesia which extends over the first three or four months of his illness and also the three months prior to its onset. Psychometric testing now proves that he has returned to his pre-illness intellectual level, there are no abnormal signs in his central nervous system, and his cerebrospinal fluid is normal. Chest X-ray reveals no evidence of the miliary spread. He has recently taken up employment as a clerk and reports that he is in excellent health.

Case 2.—The other surviving case was an airman, who at the age of 18 years developed tuberculous meningitis and came to us on the tenth day of his illness. At that time, he

was complaining of severe headache, he was confused and unco-operative, but, apart from all the signs of meningeal inflammation, there were no abnormal signs in the central nervous system. The tubercle bacillus was found on one occasion only and that by culture, so it can be assumed that this was a milder infection. His total dosage was 383.9 gm., the complete course lasting 194 days (six and a half months); he had intrathecal streptomycin for 60 days, the amount giving being 5.9 gm. This was the case where intubation of the basal cisterns was attempted but failed. Early in the treatment he developed dysphasia and a right hemiparesis and cerebral angiography at that time demonstrated a thrombosis of the left middle cerebral artery. These signs gradually subsided but four months after treatment had commenced, he began having left-sided epileptic seizures and electro-encephalography revealed an area of abnormal waves over the left fronto-parietal region. He too was in a state of dementia for several months and his treatment at times proved very difficult, but very slowly he showed improvement and eight months ago it was possible to stop all therapy. He now has returned almost to his status prior to the onset of his illness; the right hemiparesis is almost gone, although he still has a slight right facial weakness and slight clumsiness of the right hand; a recent cerebral angiogram shows that the calibre of the left middle cerebral artery and its branches is greater. Intellectually, he is back to normal, although his mental powers were never very remarkable. His cerebrospinal fluid is normal, he has the persistent vestibular and auditory defect and his seizures are well controlled with anti-convulsants. His parents consider him to have made a complete recovery and he is shortly to begin a course of industrial rehabilitation.

Comments.—Both these cases appear to have made a complete recovery but only a long-term follow-up will determine whether this is to be permanent.

The severity of tuberculous meningitis is variable and is apparently determined by the subtle interplay of "seed" and "soil," as with tuberculosis elsewhere in the body. The variables in any case are the patient's resistance—i.e. the "soil"—the virulence of the organism and the extent of the meningeal invasion—i.e. the "seed."

At the moment we can only make a very rough guess as to whether a given case is a severe or mild form of the infection and even if we knew this, it is not possible to predict how each will react to streptomycin. Until we know more of tuberculosis of the body and the central nervous system in particular, we must give the patient the best chance of combating the infection, and one of the methods by which this can be effected is to make the diagnosis early and begin streptomycin treatment at an early stage in the disease. This very important point will be amplified later.

Both these patients exhibited dementia in the acute stage of their illness and for many weeks thereafter were confused and disorientated. These mental changes are reversible phenomena, for no permanent intellectual loss or personality change has occurred. They are left with an amnesia that covers all of the acute stages and a retrograde amnesia of many weeks.

Many of the central nervous system signs that develop in a case of tuberculous meningitis (the stage of palsy of the earlier writers) are due to vascular thromboses and they can be clearly demonstrated by cerebral angiography. They do not necessarily produce any permanent disability.

These two cases have adequately shown that streptomycin has a powerful action on the tubercle bacillus and that by its use, cases of a once-fatal disease can be cured—or at least, a lengthy remission can be produced. They also

prove to us that all the labours and difficulties associated with the treatment of these patients are worth while and the gratifying results obtained have acted as a stimulus in coping with other cases.

(2) *The Fatal Cases:*

Case 3.—A soldier aged 20 years was started on streptomycin fifteen days after the onset of his meningitis. He was given a total of 106 gm. and his life was prolonged, but he died on the sixtieth day of treatment. He had a past history of a pleural effusion and, as well as tuberculous meningitis, had a tuberculous knee. This case was very difficult to treat, because after three or four weeks of lumbar intrathecal streptomycin, he developed a complete spinal block and the streptomycin had then to be given intraventricularly. This daily puncturing of the lateral ventricles caused considerable intraventricular hæmorrhage and this eventually contributed to his death, although the main cause was a slowly developing internal hydrocephalus. Throughout the treatment he remained in a demented and at times maniacal state and he was a great trial to all who were concerned with his welfare. In addition he had a considerable amount of vomiting associated with an anaphylactic reaction to the streptomycin. At post-mortem the base of his brain was studded with tubercles and there was a large one on the tentorium which apparently had not been reached by the streptomycin and no doubt was continually spilling over into the subarachnoid space. The spinal theca was completely blocked with exudate and was very hæmorrhagic. The ventricular system was dilated and contained a considerable amount of blood.

Case 4.—Another soldier of 19 years came to us late in the course of his disease—on the thirty-fifth day—and he already was drowsy and confused, hemiplegic and hemianopic. He was given 53·7 gm. of streptomycin but his condition remained unchanged and in fact gradually deteriorated, so that on the thirty-fourth day of treatment it was considered that he was blind and had in addition to his hemiplegia, bilateral ocular palsies, and all therapy was discontinued. He died ten days later, his death being hastened by a cerebral abscess which had arisen from an infected burrhole. The base of his brain showed many adhesions, especially around the optic nerves and there was a tubercle sitting on the right middle cerebral artery producing thrombosis and accounting for his left hemiplegia.

Case 5.—This case was very unsatisfactory. He was admitted late in his illness, drowsy, dysphasic and hemiplegic. Streptomycin was begun immediately but he soon became comatose and died without regaining consciousness. His brain and spinal cord revealed a typical picture of tuberculous meningitis.

Case 6.—The last fatal case was 18 years old on admission and he was treated for 45 days. He was a small, weedy youth with a tuberculous brother, and began treatment on the fourteenth day and at first improved clinically but then gradually deteriorated. Sir Hugh Cairns placed tubes in his interpeduncular fossa and he received streptomycin by this route for eight days, in addition to intramuscular and intrathecal doses daily. Again he improved but the tuberculous bacilli reappeared in the cerebrospinal fluid. He began to show the signs of increasing intracranial pressure and eventually he died in an hydrocephalic attack.

Comments.—Some cases suffer an overwhelming and persistent infection of the central nervous system which streptomycin is unable to deal with. One reason for this is seen in our first fatal case where a large tubercle was found on the tentorium, undoubtedly spilling over into, and continually reinfecting the subarachnoid space. When they are small presumably streptomycin can be much more effective against them, but as they become larger and progressively less vascular, no streptomycin can reach the core where the bacilli are found.

The organism can therefore at a later date burst into the cerebrospinal fluid, as no doubt occurred in the fourth case where acid-fast bacilli reappeared in the cerebrospinal fluid after twenty-seven days' treatment. Evidently in this case the streptomycin was unable to deal with this reinfection although the youth's resistance was probably never very high.

Therefore one of the objectives in combating the tuberculous processes, is to begin treatment with streptomycin early and thus prevent the formation of large caseating foci—providing that other factors, such as resistance and magnitude of infection, are favourable.

Adhesion formation is another characteristic of tuberculous meningitis, and once they are firmly established about the base of the brain, streptomycin has little or no effect upon them. They continue to extend and by so doing strangle the cranial nerves and block the cerebrospinal fluid pathway so creating an internal hydrocephalus which eventually kills the patient, as in all these fatal cases. Again it is obvious that the earlier streptomycin is begun, the less chance of extensive adhesion formation there is.

It will be seen that all these cases were started treatment rather late and in the presence of heavy infections in men whose resistance can be assumed to have been low. On the whole, it is useless treating moribund and far-advanced cases although occasionally it takes a great deal of experience to say whether an individual case should have streptomycin or not. Thus again the value of an experienced team.

(3) Cases Still Under Treatment:

Case 7.—A youth of 20 years whose tuberculous meningitis is secondary to Pott's disease of the sixth and seventh dorsal vertebræ began therapy after about fourteen days of headache and meningeal signs. He was at first drowsy, mute and irritable but following the tapping of both lateral ventricles, he improved dramatically. He continued to make progress and was given 5.1 grm. of streptomycin intrathecally over a period of two months but on the eighty-fourth day of treatment he suddenly developed a partial right third cranial nerve paralysis. This was almost certainly of vascular origin and indicating that the disease was still active. On the 136th day, he found that he was unable to move his right arm and leg and indeed had a complete, flaccid hemiplegia. Since then he has made slow improvement, the third nerve lesion practically disappearing and the hemiplegia improving slightly. He has now had 283.1 grm. of streptomycin altogether; there are still many days of treatment ahead of him. It is interesting to note that the spinal tuberculosis is showing radiological improvement.

Case 8.—The second case at present under treatment is an 18-year-old soldier who began treatment several weeks after the onset of vague general symptoms and was in very poor condition. He has now had 117 days treatment and all that can be said is that the disease has been stayed and his life prolonged.

Case 9.—The other current case is much more hopeful and provides an excellent example of early diagnosis and early treatment. He will be discussed in detail later.

Comments.—Most of the cases have had burrholes made at some stage in their treatment. As with the first of the current cases, the relief of the high intracranial pressure frequently produces dramatic improvement. In addition, it is always safe to have a means of rapidly tapping the lateral ventricles should the patient suddenly develop increased intracranial tension. If the patient develops a spinal cerebrospinal fluid block, burrholes will be necessary, so that

streptomycin may be given directly into the ventricles. Another reason for providing an approach to the ventricles, is that if the diagnosis is in doubt a ventriculogram can be performed, and thus a space-occupying lesion (e.g. a cerebral abscess) excluded.

It is convenient here to mention another case not included above:

This was an 18-year-old private in the A.T.S. who presented three weeks ago with a ten or twelve day history of headache, dizziness, nausea and stiff neck. She was drowsy, with severe meningeal signs but no localizing signs in the central nervous system. The cerebrospinal fluid was typical of tuberculous meningitis although no acid-fast bacilli could be found. Considering that she was a case of tuberculous meningitis intrathecal and intramuscular streptomycin was commenced, and soon after she developed a complete left hemiplegia. Gradually it became obvious that she was not behaving clinically like any of the previous cases and the cerebrospinal fluid was improving. In addition, no tubercle bacilli were found and after fourteen days intrathecal streptomycin it was considered that she was not a case of tuberculous meningitis and this was stopped. She is now improving and the intramuscular drug will soon be stopped. The diagnosis is still uncertain but she is probably a case of polioencephalitis.

This case illustrates the necessity for commencing streptomycin therapy early, even if the diagnosis is not quite certain. If the clinical picture and cerebrospinal fluid findings are suggestive of tuberculous meningitis, yet the acid-fast bacillus cannot be found on smear, it is wrong to delay action. Streptomycin should be commenced at once. In the proved cases of tuberculous meningitis where streptomycin therapy was begun prior to finding the tubercle bacillus, it has invariably appeared on culture later. Two weeks of the intrathecal and intramuscular drug should be given and the clinical course and cerebrospinal fluid watched carefully. If it is judged that the patient is not behaving like a case of tuberculous meningitis (for example, if improvement clinically or in cerebrospinal fluid is shown) and the organism is not found the streptomycin can be stopped, there being little possibility of toxic effects developing during this short period.

In this way, a few cases other than tuberculous meningitis will be treated and some streptomycin wasted, but it means that all cases of tuberculous meningitis are started early with their treatment and this is a most important factor in their ultimate prognosis.

THE IMPORTANCE OF EARLY DIAGNOSIS OF TUBERCULOUS MENINGITIS

The treatment of tuberculous meningitis with streptomycin is still in its infancy, there being many inexplicable features. As each case varies according to the intensity of the infection, the resistance of the individual and perhaps the virulence of the organism, response to streptomycin differs equally. We have seen advanced cases treated with success and equally advanced cases result in death. There are thus many gaps in our knowledge which no doubt are due to the fact that as the disease in the past was uniformly fatal, it was never studied with the intensity that it is receiving at the moment.

But until more is known the general opinion is that antibiotic therapy should be commenced as early as possible. This demands an accurate knowledge of the clinical picture so that a diagnosis can be made at an early stage in the disease.

Appeals for an early diagnosis in tuberculous meningitis are by no means new. More than one hundred years ago, when the disease was known as "acute hydrocephalus" most of the clinicians emphasized the necessity of making the diagnosis early and instituting heroic measures immediately. They each claim to have had a few cures but no doubt their diagnoses were incorrect and they confused tuberculous meningitis with other forms of meningitis and encephalitis. Robert Whytt [13] who in 1768 gave the first detailed description of the disease ("Observations on the Dropsy in the Brain") was a little more accurate when he stated: "I freely own that I have never been so lucky to cure one patient who had those symptoms which certainly denote this disease. And I suspect that those who imagine they have been more successful have mistaken another distemper for this." However, he too called for an early diagnosis. It is to be remembered that spontaneous recoveries have occurred, e.g. Case 18 of Smith, Vollum and Cairns [5], Jennings [14], Hobson [15], and Parry [16].

When bacteriology became established as a science and lumbar puncture was introduced by Quincke in 1891, tuberculous meningitis became a more definite clinical entity and it then became evident that in all but extremely rare instances, the disease always resulted in death, no matter what therapeutic measures were undertaken. After many trials with dismal failure, it became accepted that all cases of tuberculous meningitis died and the diagnosing of the disease was a veritable death sentence. Thus a certain apathy among clinicians became evident and it was merely a painful necessity to confirm the diagnosis; there was certainly no need to do anything in haste, for the case was hopeless and doomed from the onset.

This attitude has been present until the introduction of streptomycin as a therapeutic agent in the treatment of tuberculosis and it is one that must be now vigorously combated. We have a valuable drug which has undoubted anti-bacterial properties but to give it the greatest possible chance, it must be given early in the disease before irreversible pathological changes take place.

Recently, an excellent example of the gratifying results obtained by early diagnosis and treatment, has been observed. This is Case 9 mentioned above. When he arrived, he was rational and co-operative and his meningeal irritation neither severe nor incapacitating. Thus, unlike most of the other cases, he could give a detailed and accurate history. He could state the exact date when he first fell sick, and this was two weeks prior to admission. He told of a vague, pyrexial illness associated with a painful and swollen right knee. The fever was remittent, the B.S.R. was high and the white cells count was 7,300. The joint pain and swelling soon subsided after a few days' treatment with sodium salicylate but the pyrexia remained, with no other symptoms apart from general malaise and lack of energy, until five days before admission when, for the first time, he complained of headache. The medical officer was already suspicious about this case and he was doubtful about his original diagnosis of rheumatic fever. Therefore, when the day before admission meningitic signs appeared, a lumbar puncture was done at once and the cerebrospinal fluid found to be abnormal and suggestive of tuberculous meningitis. Without delay, the man was sent for streptomycin treatment, and this was begun a few hours after admis-

sion despite the fact that the tubercle bacillus was not at that time found in the cerebrospinal fluid. The acid-fast bacillus has since been found by smear and culture in the cerebrospinal fluid in considerable numbers.

He never had any marked mental changes nor was he particularly drowsy and the signs of meningeal irritation were mild at all times; no localizing signs in the central nervous system have occurred. He now has had 114 days of treatment and has received a total of 219.8 gm. of streptomycin during this time; the intrathecal doses were given for forty-eight hours. He is up and about the hospital now with no symptoms at all and apart from a slightly abnormal cerebrospinal fluid and absent caloric responses together with high tone hearing loss, he is apparently quite normal. He is still receiving intramuscular streptomycin so the cerebrospinal fluid abnormality is partly due to this factor; but, even after the cessation of all treatment, the cerebrospinal fluid takes months to return to normal.

It is unwise to draw any definite conclusions from a single case, but it would appear that the instigation of treatment early in this patient is the main factor in the excellent result that has been obtained. His meningeal infection was quite a severe one, the organism being found in large numbers at the onset, and there is no question of him having had a mild form of the disease. The degree of his resistance is an unknown quantity, as is the virulence of the bacillus, but no doubt they were in his favour. Although it is still a little early to claim that he has made a permanent recovery, the course of this man's illness has been nothing less than dramatic and his present condition is most gratifying.

EARLY STAGES OF THE DISEASE AND CEREBROSPINAL FLUID CHANGES

In order to recognize tuberculous meningitis early, a thorough knowledge of the various forms that it may take is essential. The following description is limited to the picture as seen in adults, the diagnosis in children often being much more difficult. The patient is usually around 20 years of age and there is almost always a prodromal period of vague symptoms, before irritation of the meninges becomes apparent. The patient feels a little "off colour" and he finds that he has not got quite the same amount of energy that he used to have, his appetite may become poor, he perhaps has a few night sweats and some insomnia and his relatives or friends may notice that he is losing weight and not looking so well. Several of these cases began with a sore throat, two at least had abdominal pain, and obstinate constipation is a common and important symptom. Occasionally psychiatric symptoms may predominate and one of the cases was labelled as a psychotic and another as an hysteric. On examination the fever comes and goes, the pulse may be more rapid than normal and the B.S.R. is elevated and the white count is never very high, being usually about 10,000. The conjunctivæ may be injected. The case is labelled as a "P.U.O." but must be observed with great care. Should headache develop, persist and gradually become more severe, the alarm should be sounded and if it does not subside, the cerebrospinal fluid should be examined—even before the signs of meningeal irritation appear; it has been found occasionally that cerebrospinal fluid abnormalities are present before gross evidence of meningitis develops.

An accurate pressure should be taken and an adequate specimen should be withdrawn so that a full analysis—cells (total number and differential), protein, chlorides, sugar and smears and cultures for acid-fast bacilli and pyogenic organisms—can be carried out. It should be remembered that lumbar puncture done under rigidly aseptic conditions is a harmless procedure and one should never hesitate to use it when the diagnosis is in any way doubtful.

As the headache, which is almost always bifrontal, increases vomiting may occur and stiffness and aching of the neck, photophobia, Kernigism and *tâche cérébrale* appear, showing that the meninges have been invaded. At this stage we have found diplopia to be a common symptom, although it may be impossible to demonstrate any actual ocular muscle paresis. When this picture is present and the cerebrospinal fluid suggests a tuberculous infection, even though the tubercle bacillus has not been found, every minute counts and the patient should be transferred without delay to a centre where a streptomycin team is available; these cases usually travel quite well. No doubt mistakes will be made and non-tuberculous cases will be sent for streptomycin therapy. But even experts have difficulty differentiating these cases and streptomycin should be started although the diagnosis is doubtful.

Until the onset of persistent, severe headache, the indefinite prodromal symptoms and signs which can exist for one to four weeks, can fit into many disease pictures and even with the onset of cerebral symptoms cerebrospinal fluid examination is the only means of differentiating tuberculous meningitis from other forms of meningitis.

To help us in acquiring a detailed knowledge of this disease it is valuable to consult the works of the eighteenth and nineteenth century physicians who only had the appearance of the patient, his complaints and his relatives' opinions and then later the gross appearances of the brain and spinal cord to help him make the diagnosis. Referring again to Whytt [17], we find the following significant summing up which, although including only children, for at that time this disease was considered to be of childhood only, is equally applicable to the older patients.

"When we meet with a patient under 15 or 16 years of age seized with a slow fever of no certain type, and irregular in its accession and remission; when in that fever, the patients vomit once a day or once in two or three days; when they shun the light and complain of pain in the crown of their head or over their eyes, after the fever has continued for some time or of a pain thereabouts that in some days does not abate like the headache in ordinary fevers; when their complaints neither yield much to repeated vomits, gentle purges or blisters I say there is reason to suspect water in the ventricles of the brain."

The clinical picture, however, varies considerably and the diagnosis is often very difficult to make. It may be that headache and pyrexia are the first indications of the disease and signs of meningeal irritation follow quickly. Very occasionally the first incident may be an epileptic seizure in an otherwise healthy person, with the picture of meningitis developing rapidly. Thus it is inevitable that atypical cases may remain undiagnosed or be diagnosed too late to begin treatment with streptomycin. If, however, examination of the cerebrospinal

fluid is used as a routine procedure in all doubtful cases, these failures will be minimal.

The important point is the prompt examination of the cerebrospinal fluid and at an early stage in the illness, a lumbar puncture can do no harm. It may be found that the fluid is normal, but, should symptoms and signs persist unabated, a second and if necessary repeated lumbar puncture should be done.

The cerebrospinal fluid is usually under increased pressure, a much more elevated reading being obtained with struggling patients in the acute, irritable stage. The fluid is slightly opalescent and characteristically forms a cobweb clot, this being a fertile source of acid-fast bacilli. The cell count is increased, there being usually two to three hundred cells present but values can range from 20 to 850. The predominating type of cell is the lymphocyte, the proportion being usually 75-90 per cent with the remainder made up of polymorphs; this proportion of cells is quite typical of tuberculous meningitis. The protein content is raised, varying from the upper limits of normal to 200 or 300 mg. per cent. Characteristically the chlorides are low, but this is not invariable as most textbooks would have us believe. There have been verified cases where the chlorides have never been lower than 700 mg. per cent. If several lumbar punctures have been performed, it can be seen that as the disease progresses the chloride content of the cerebrospinal fluid falls gradually. It is thought that the low cerebrospinal fluid chloride level is in part due to the vomiting which is characteristic of tuberculous meningitis in the early stages. Similarly, the cerebrospinal fluid sugar is reduced in quantity and it too can be shown to decrease gradually over a period of a few days. This gradual fall in the chloride and sugar content of the cerebrospinal fluid is an important diagnostic point, for it helps to differentiate tuberculous meningitis from other forms of lymphocytic meningitis, especially the neurotropic virus type, where the levels are unaltered. It is important to use a quantitative method (as is used for the blood) in determining the sugar content and not the usual qualitative one. As mentioned above, the estimation of sugar in the cerebrospinal fluid once streptomycin has been given, is useless.

A most intense search for the tubercle bacillus in smears is essential, remembering that the number of bacilli found varies directly with the time and care spent in looking for them. Inoculation of culture media (and if available, a guinea-pig) are also necessary. One of our cases showed the tubercle bacillus once only, and this was on culture.

Although a single quantitative report indicating the number of acid-fast bacilli present in the cerebrospinal fluid (according to the method of Gaffky which is usually applied to the sputum) would be valueless, a series of them would give some indication of the severity of the infection.

Special tests applied to the cerebrospinal fluid such as the tryptophan test [18] and Levinson's test [19] are said to be indicative of tuberculous meningitis but not specifically diagnostic; they have not been employed in this series.

As most of the tuberculous activity is around the base of the brain, a sample of cerebrospinal fluid from the cisterna magna should be more likely to con-

tain the tubercle bacillus. Thus a cisternal puncture as a diagnostic measure, if the lumbar fluid does not show the organism, may be of value.

Additional factors have occasionally helped with the diagnosis. Four of the cases had a definite history of contact with tuberculous subjects and in one it was less definite. One case had a history of previous tuberculous disease (lymphocytic pleural effusion and tuberculous arthritis of knee) and one had an active tuberculous focus (dorsal spine). The B.S.R. was raised in the early stages of all cases except one and it gradually fell as the disease subsided. A positive Mantoux was present in all cases.

Choroidal tubercles have not been found in any of the cases despite adequate ophthalmoscopic examination, short of dilatation of the pupils. This latter procedure has not been resorted to as it is considered just as important to observe the pupillary reactions as the presence or absence of tubercles.

In the case of patients already being treated for active tuberculosis elsewhere in the body, or cases known to have had a tuberculous lesion in the past, or are, or have been, in contact with tuberculous persons, a strict watch for spread to the meninges should be kept. Patients already under treatment for a tuberculous focus, will probably show no prodromal signs or symptoms, meningeal irritation being the first indication of impending meningitis. There should be no excuse for the failure to diagnose tuberculous meningitis very early in these cases. When miliary tuberculosis is being treated with streptomycin routine lumbar punctures should be done, for a few cases have been described where frank meningitis developed during a course of streptomycin and the only indication was in the cerebrospinal fluid. Intrathecal streptomycin can then be commenced at the earliest possible moment.

LATER STAGES OF THE DISEASE

The prodromal stage and the stage of early meningeal irritation are the most advantageous times to commence streptomycin. As the disease progresses, the chances of streptomycin being effective are greatly diminished. The patient now advances through the stage of meningeal irritation, and drowsiness, confusion and disorientation occur with nocturnal delirium and active hallucinating. At times the patient may become maniacal and he becomes very difficult to manage. This is the stage that was prolonged by streptomycin treatment, in our fatal cases. There may be fleeting muscular twitchings especially of the face and plucking at the bedclothes and garments is very characteristic. Pyrexia is present and the pulse rate having been increased during the preceding stage now slows down and respirations are increased. Cranial nerve palsies, dysphasia, mutism, hemiparesis or hemiplegia, hemianopia, hemianæsthesia and other neurological signs appear. It is now becoming too late to begin streptomycin therapy, the drowsiness develops into coma and signs of increased intracranial pressure predict a fatal outcome.

An attempt has been made to outline the course of tuberculous meningitis and although some cases present the four typical stages, usually mentioned in the textbooks—

(1) Prodromal signs and symptoms;

- (2) Signs and symptoms of meningeal irritation;
- (3) Cranial nerve palsies, dysphasia, paralyses, etc.;
- (4) Increasing intracranial hypertension with coma and eventually death—many more do not follow this course. But if the cerebrospinal fluid is adequately examined early enough in a pyrexia of undetermined origin which develops signs and symptoms indicating meningeal infection, an early diagnosis will be made much more frequently. With the diagnosis made early or even strongly suspected, streptomycin can be started without delay.

Thomas Watson [20] in 1843 summarized perfectly this plea for early diagnosis, and thus early treatment with streptomycin, when describing "acute and general inflammation of the encephalon."

"It is quite plain that for an organ so essential to life and of such delicate organization as the brain, wherein changes so irreparable in their nature as many of those I have just enumerated, so readily take place under acute inflammation, we cannot hope to be of much service unless we see and treat the case at an early period. On this account it becomes exceedingly important to recognize the nature of the disease, at its very commencement; and, therefore, I have taken pains to point out to you the various forms which it may assume, while it is yet within the reach of remedial measures."

SUMMARY

- (1) A general account of the use of streptomycin in the treatment of tuberculous meningitis is given, which includes the theory and dosage of the drug, its toxicity and the resistance of the tubercle bacillus to it.
- (2) Six cases have been treated with streptomycin and of these two have survived. These are described and also the three cases still undergoing treatment. The importance of early treatment is emphasized and the treatment of suspected cases discussed.
- (3) Finally a plea for early diagnosis is made and the benefits of early therapy are well illustrated by the results obtained in a recent case. The possible clinical findings are described and the necessity for early examination of the cerebrospinal fluid is stressed.

My thanks are due to Professor Sir Hugh Cairns under whose care all these cases have been, and who has very kindly allowed me to report on them. I would like also to express my gratitude to all the medical officers, nursing sisters and orderlies of the Military Hospital for Head Injuries who have assisted in the management of these difficult cases.

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SOME PATHOLOGICAL ASPECTS OF TUBERCULOUS MENINGITIS TREATED WITH STREPTOMYCIN

BY

Major G. B. S. ROBERTS

Royal Army Medical Corps

In treating tuberculous meningitis it is essential that an accurate diagnosis be made as early as possible in the course of the disease. The early clinical signs which should make one suspect tuberculous meningitis have been described by Captain Clarke in his paper and he has stressed the importance of early examination of C.S.F. in all suspicious cases.

While there are no cytological or chemical features in the C.S.F. which can be said to be absolutely diagnostic of tuberculous meningitis, yet the findings may be suggestive and enable a provisional diagnosis to be made subject to confirmation by finding the bacillus.

The following are brief summaries of the methods used by this department:

CYTOLOGY

Many methods of performing C.S.F. cell counts are described and almost all of these are quite satisfactory provided they are carried out by the same operator to reduce personal error to a minimum. It is very important that the count should be performed as soon as possible after withdrawal of the fluid from the body, normally within one hour. The most common error in doing C.S.F. cell counts is to count red cells as white and to obviate this it is considered advantageous in routine work to lyse the red cells by acid. As noted below, however, separate red cell counts may be performed if required.

TECHNIQUE

The C.S.F. containers must be thoroughly shaken to obtain an even suspension of cells immediately before the fluid is withdrawn for the cell count. A white cell blood pipette is used and filled to the mark "1" with C.S.F. diluting fluid and then with C.S.F. to the mark "2." This is fixed and allowed to stand for three minutes to allow the cells to stain, then mixed again and a drop placed in the counting chamber in the normal fashion. It is advisable to use a chamber with a large area, e.g.

(I) An improved Neubauer. With this type of chamber if the cells in the whole area, i.e. 9 sq. mm. are counted then the number of cells/cm. of C.S.F. = $\text{No.} \times \frac{10}{9} \times \frac{10}{9}$ or for practical purposes $\text{No.} \times \frac{5}{4}$.

Alternatively, (II) A Fuchs Rosenthal chamber may be used. This has an area of 16 sq. mm. and a depth of 0.2 mm. $\text{No. of cells in whole area} \times \frac{5}{16} \times \frac{10}{9} = \text{cells per c.mm.} = \text{approximately No.} \times \frac{1}{3}$.

Alternatively, an area of 4.5 sq. mm., i.e. $4\frac{1}{2}$ large squares, may be counted giving a direct reading.

The combined stain and diluting fluid used is:

Crystal violet	...	...	...	0.5 c.c.
Acetic Acid	...	...	...	15.0 c.c.
Distilled water	...	...	...	250.0 c.c.

As acetic acid may be unreliable in producing lysis of red cells the following fluid may be used:

Brilliant cresyl blue	...	...	2 gm.
M/1 hydrochloric acid	...	...	100 c.c.

Lysis of red cells by this method is very complete but it has the disadvantage that the staining of white cells is poor. It is only recommended if the number of red cells is very large. Red cells in C.S.F. may be very simply counted by a similar method except that the diluting fluid should be a simple stain with no acetic acid added. Toluidin blue (0.5 per cent aqueous solution) has proved very satisfactory.

If the total cell count is low differential cell counts are best done from the counting chamber while the total cell count is being done. Otherwise this may be done from stained dried films of centrifuged deposit.

CHLORIDES

A standard solution of silver nitrate is prepared containing 0.2907 per cent silver nitrate by weight. This is standardized against a 1 per cent solution of sodium chloride.

1 c.c. of C.S.F. is placed in a suitable container and diluted to about 5 c.c. with distilled water and a few drops of a 10 per cent potassium chromate added as an indicator. The silver solution is run in from a burette until the indicator changes to a rust red colour. If the silver nitrate solution is exactly 0.2907 per cent then each c.c. used in the titration is equivalent to 100 mg. NaCl per 100 c.c. of C.S.F.

PROTEIN

1 c.c. of C.S.F. is placed in a small test tube and 0.2 c.c. of a 25 per cent trichloroacetic acid solution is added. The resulting solution is compared with a series of standard opacity proteinometer tubes. The most satisfactory method of making a reading is to attempt to read print through the tubes. Readings are most difficult in the 40 to 60 mg. range and with such readings it is our practice to carry out a Pandey and Nonne-Apelt test, in an attempt to confirm whether the amount of protein present is pathological.

When the protein value exceeds 100 mg. per cent the C.S.F. is first diluted with normal saline an appropriate number of times, and 1 c.c. of this diluted fluid is treated with 0.2 c.c. of trichloroacetic acid as above, the reading is multiplied by the appropriate factor.

SUGAR QUALITATIVE

Qualitative examination of C.S.F. for sugar gives little useful information and for this reason quantitative estimations of sugar have been done on all cases of suspected tuberculous meningitis.

Folin and Wu's method is sufficiently accurate and has been used here for some considerable time.

The following is a summary of this method:

To 1 c.c. of C.S.F. add:

0.25 c.c. $2/3$ N sulphuric acid.

0.25 c.c. 10 per cent sodium tungstate.

8.5 c.c. distilled water.

Allow to stand and filter.

In a Folin and Wu's tube place

2 c.c. filtrate.

2 c.c. alkaline copper sulphate. (Folin and Wu)

Place in a boiling water bath for exactly six minutes. Cool rapidly for not more than two minutes.

Add 2 c.c. of phosphomolybdic acid and when bubbling has ceased make up to 12.5 c.c. with distilled water. Compare colour against known standard. If a Lovibond comparator is used the figure read off is divided by 4.

Estimation of sugar in C.S.F. after the commencement of treatment with streptomycin has been found to be valueless as streptomycin itself is a strong reducing substance.

DETECTION OF TUBERCLE BACILLI

Containers for C.S.F. must be scrupulously clean as well as sterile. Rubber washers from inside of metal screw caps should be boiled separately in distilled water and then refitted. On no account must cork stopper be used.

In the identification of tubercle bacilli only organisms which are absolutely typical in shape, size, staining, etc., should be regarded as "positive." Unless the suspected organism conforms in all respects it should not be regarded as conclusive.

In almost all cases it has been possible to find tubercle bacilli on direct examination. Considerable time, however, must be spent on the exploration of smears as the bacilli are often extremely scanty.

Part of the C.S.F. submitted is used for the tests outlined above and part is spun down in a centrifuge and smears are made from the deposit. These are stained by Ziehl Neelsen's method, and searched for bacilli using a mechanical stage covering the slide from end to end. A useful economy is to do estimations of sugar and chloride on the supernatant fluid from the centrifuge tube.

A further portion of the C.S.F. is placed in the incubator overnight and examined the following day. This practice has been well worth while in our experience and has yielded a large number of positive results. If any cobweb

clot forms in the specimen it should be carefully removed and spread on a slide and examined.

Culture of the C.S.F. was carried out in all cases. It is considered that to obtain consistent positive results the volume of the inoculum should be as large as possible. Two methods were used throughout.

(1) Centrifuged deposit or clot was inoculated on slopes of Lowenstein Jensen media, generally three slopes being inoculated from each specimen.

(2) A more satisfactory method was the use of a fluid medium—Kirschner's (Kirschner, O. (1932), *Cent. Bakt.*, **124**, 404)—being the one used here. This has the great advantage that large volumes of C.S.F. may be added to the prepared media.

The method of preparation is

Disodium hydrogen phosphate	...	3.0	gram.
Potassium dihydrogen phosphate	...	4.0	gram.
Magnesium sulphate	... ..	0.6	gram.
Sodium sulphate	... ..	2.5	gram.
Asparagine	... ..	5.0	gram.
Glycerine	... ..	20.0	gram.
Aqua destillata	... ..	1,000.0	gram.

Sterilize.

Before use add 10 per cent sterile serum (human, horse, bovine or rabbit).

Adjust reaction to a pH of 7.4.

Add penicillin to a concentration of 5 - 10 units/ml.

Guinea-pig inoculation was also carried out in some cases but this method appeared to offer little advantage as the results with film and culture were so consistent.

STREPTOMYCIN CONTENT

The streptomycin content of the C.S.F. was estimated at frequent intervals using a modification of Mitchison's diffusion method for which (the method is given as an appendix) fairly uniform C.S.F. streptomycin levels were found in all cases under treatment. Fig. 1 shows some of these results.

STREPTOMYCIN SENSITIVITY

The streptomycin sensitivity of the tubercle bacilli recovered from culture was estimated. In this series of cases the organisms all remained positive to streptomycin throughout the whole course of the treatment. In no case was it found that the C.S.F. yielded a growth of highly resistant tubercle bacilli.

DIFFERENTIAL DIAGNOSIS

It has been stressed above that the only certain method of diagnosing tuberculous meningitis is the demonstration of tubercle bacilli. A large variety of conditions produce a lymphocytic response in the C.S.F. and these must all be considered.

Tuberculoma, another type of intracranial tuberculosis, may closely simulate tuberculous meningitis. Every effort should be made, however, to differentiate the two lesions as the immediate prognosis of tuberculoma is good and spon-

taneous "cure" may occur. Although it may be silent and the C.S.F. normal for a long time, yet a leak may occur, and the cell count can rise very considerably and then fall slowly to normal without any treatment. At the same time tubercle bacilli may or may not be found, a growth of tubercle bacilli was obtained from a single specimen of C.S.F. from the A.T.S. girl mentioned by Captain Clarke and it is thought probable that she has a tuberculoma.

Benign lymphocytic choriomeningitis is another lesion which closely simulates T.B. meningitis, but which undergoes spontaneous recovery. Accurate diagnosis of this condition is now possible by complement-fixation methods. In this condition the C.S.F. cell count is raised and predominantly lymphocytic. It is stated that the C.S.F. sugar does not fall as in T.B. meningitis but we have not sufficient cases to be able to express an opinion on this observation.

Poliomyelitis, cerebral abscess, encephalitis and even cerebral tumour may all give C.S.F.s practically identical with T.B. meningitis. The differentiation of these conditions is generally on clinical grounds.

CEREBROSPINAL FLUID IN THE EARLY STAGES OF THE DISEASE

The fluid is usually under increased pressure. Manometric readings usually being between 250 and 300 mm. of water. The fluid comes freely from the needle and 10 to 15 c.c. may be withdrawn with safety.

The fluid is generally crystal clear. The cobweb clot described in so many textbooks is not often seen in the early stages, and its formation appears to depend directly upon the amount of protein present. A clot, however, may sometimes form if the fluid is allowed to stand overnight in the incubator.

The cell count is increased averaging 300 cells per c.mm., with extreme values ranging from 80 to 600. The majority of the cells present are lymphocytic with 25 to 5 per cent of polymorphs.

Protein content is also increased the actual figures generally being between 100 and 150 mg. per cent.

Chlorides are diminished, 640 mg. per cent being the average level in the initial stages, in our cases, glucose content too is diminished—negative reaction generally being obtained when a quantitative Benedicts was performed. If estimated quantitatively the sugar content is found to be about 40 mg. per cent.

If the case is kept under observation the chloride and sugar content of the C.S.F. show a tendency to fall. In one of our cases the sugar content was found to be 50, 35, 30 mg. per cent on three successive examinations. It is valueless to carry out sugar estimations in the C.S.F. once streptomycin therapy has been commenced, as the drug itself is a strong reducing agent.

CHANGES IN C.S.F. IN CASES UNDER TREATMENT

The most striking feature in cases of T.B. meningitis is the very marked variation which occurs in the C.S.F. in a short space of time—changes which apparently are unrelated to any change in the patient's clinical condition. While the cell count shows the greatest variation, the protein content also shows wide fluctuation. The chloride content on the other hand remains relatively constant over a period showing only a slow rise or fall.

In general terms it can be said that once treatment has been commenced the cell count continues to rise for two or three weeks, sometimes reaching a fairly high figure and then falls steadily. The protein too may show a similar rise followed by a slow fall. The chloride content returning to normal more slowly than the cells. The chloride content in our successful cases has shown a slow rise to normal. These results are shown graphically in figs. 1 and 2.

Tubercle bacilli can generally be found either by smear or culture in the C.S.F. for one to three weeks. Its persistence after this time or its reappearance is regarded as a bad prognostic sign.

The following is a brief summary of the findings at post-mortem in the fatal cases in this series.

Case 3.—The right lung showed a healed primary subpleural focus with calcification of the hilar lymph nodes. This lung was firmly bound to the chest wall by diffuse dense fibrous adhesions, the appearance being that of a healed tuberculous pleurisy. In addition the patient had a tuberculous left knee and had a large tuberculous mass in his

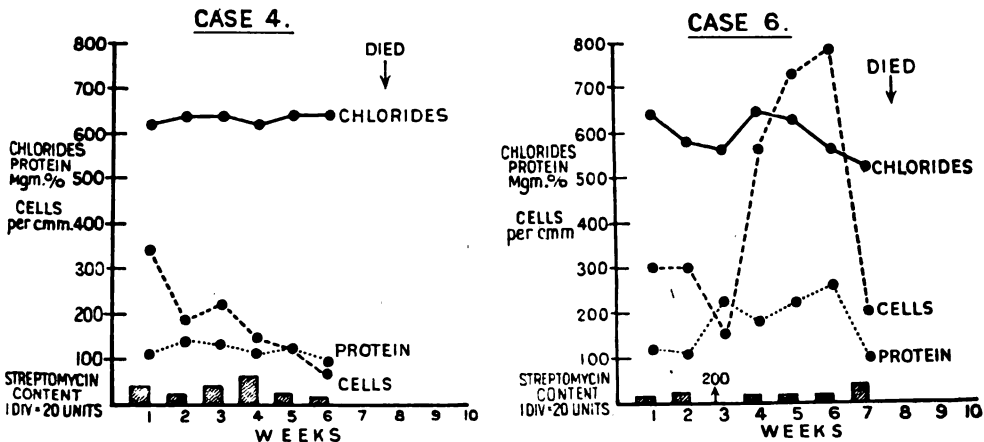


FIG. 1 (Cases 4 and 6).—Fatal cases. The graphs show the cells, protein, chloride and streptomycin content of the C.S.F. under treatment.

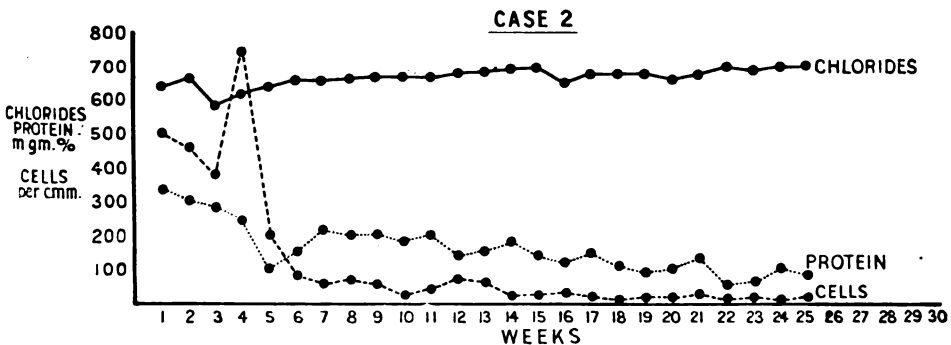


FIG. 2 (Case 2).—This case did well and was eventually discharged apparently cured. The graph shows the slow rise of chlorides to normal and the gradual fall of cells and protein. The sharp rise in the cell count after about four weeks' treatment has occurred in a number of our cases and by itself does not appear to be a bad prognostic sign.

mesentery. This had given rise to tuberculous peritonitis. A small tuberculoma was present in the cerebellum. This has become adherent to the dura. Signs of tuberculous meningitis were minimal at the base of the brain, but very gross tuberculous involvement of the spinal meninges was present (*see* fig. 3).

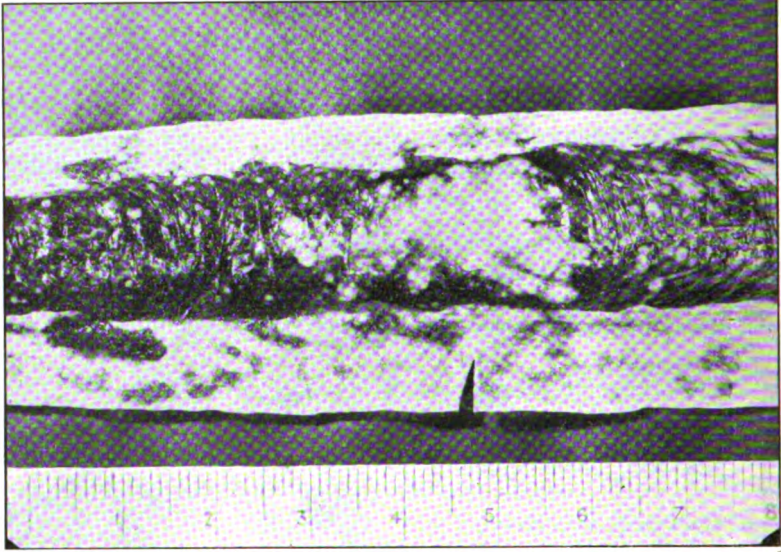


FIG. 3 (*Case 3*).—This shows a portion of the spinal cord. Abundant large tubercles are present coalescing on one area. A considerable amount of hæmorrhage is present.

On section of the brain hæmorrhage into the dilated lateral ventricle was seen.

This case is an example of a healed primary tuberculous lesion, with many secondary tuberculous lesions—knee, peritonitis and brain. Escape of infected material from the cerebellar tuberculoma is considered to be the cause of the meningitis.

Case 4.—In this case an active subpleural lesion with large caseous tuberculous bronchial lymph nodes was found (*see* fig. 4). A scanty miliary spread is seen in lungs and spleen. The base of the brain was covered with a very dense fibrous membrane, particularly around the optic chiasma. Small tubercles are seen along the cerebral vessels, and a small tuberculoma is present on the right middle cerebral artery (fig. 5). On section the brain shows gross internal hydrocephalus.

This case is an example of a primary tuberculous infection in a young adult which has progressed to miliary spread of tubercle bacilli. These have settled predominantly on the meninges and caused meningitis.

This type of case would offer least chance of successful treatment as the patient's resistance of the spread of tubercle bacilli would appear to be low.

Case 5.—This case showed an active pulmonary lesion with caseous mediastinal lymph nodes. A very gross miliary spread was present to all organs in the body including the brain.

Case 6.—In this case there were abundant tubercles both on the vertex and basal surfaces of the brain and a considerable amount of fibrous exudate was present, in the interpeduncular fossa, Sylvian fissures and mid-brain. The cerebral convolutions showed marked flattening and on section internal hydrocephalus was noted.

No primary site of the tuberculous infection was found.

ACKNOWLEDGMENTS

I wish to thank Dr. R. L. Vollum of the Radcliffe Infirmary, Oxford, for



FIG. 4 (Case 4).—This view of the lung shows caseous tuberculous hila lymph nodes related to the subpleural lesion.

carrying out streptomycin estimations on these cases and advice on many problems on this subject.

APPENDIX

MITCHISON'S DIFFUSION METHOD FOR ASSAY OF STREPTOMYCIN

Principle.—Streptomycin diffuses through a staphylococcus-inoculated agar causing a clearly marked zone of inhibition after eighteen hours' incubation. The zone of inhibition is proportional to the concentration of streptomycin.

Summary of Method.—A special diffusion agar is melted and cooled to 45° C. and then inoculated with an optimum amount of staphylococcus culture. The nutrient agar is in 19 mil. amounts in 1 oz. wide-necked bottles. For inoculum 0.4 ml. of an overnight broth culture of staphylococcus is added to 10 ml. of $\frac{1}{4}$ strength saline, mixed, and 1 ml. of the suspension is added to the bottle of agar, which is then shaken vigorously for half a minute. Place the bottle in a 45° C. water bath, and wait for a minute to allow the larger bubbles of air to rise to the top of the medium. The agar is then pipetted into 3 mm. diameter tubes, to form a column 2 cm. deep. The tubes should be kept in a rack which will keep them vertical throughout the test. When the agar has solidified the streptomycin standard solutions and unknowns are pipetted on to the surface of the agar. The depth of the fluid is immaterial, except that it should be greater than 1 mm. The rack is incubated at 37° C. for eighteen hours and the zones of inhibition measured.

For measuring the zone of diffusion use a microscope equipped with a $\frac{2}{3}$ objective, No. 2 ocular fitted with a hair-line, and a mechanical stage fitted with a Vernier scale. Mount the diffusion tube in a cradle of plasticine on a slide, and measure the distance from the agar meniscus to the foremost and largest demarcation line of the staphylococcus colonies.

Calculations.—The usual preliminary before adopting the test is to set up in triplicate

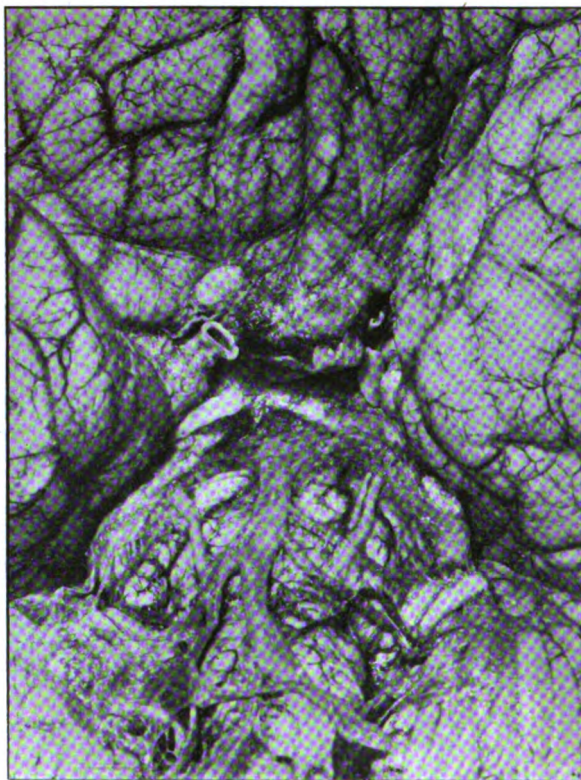


FIG. 5 (*Case 4*).—This view of the base of the brain shows the optic nerves bound in very dense fibrous tissue. A small tuberculoma is present on the right middle cerebral artery just after its commencement. Tubercles are scanty but may be seen near the olfactory nerves.

falling concentrations of streptomycin, namely 64, 32, 16, 8, 4, 2, units per ml. The zones of diffusion are accurately measured to the first place of decimals. The average of the three readings is squared and the figure is plotted against the logarithm of the concentration of streptomycin. For concentrations between 2 and 64 units per ml. the points should fall on a straight line. If they do not fall on a straight line there is some error in the method. Once linearity has been achieved only three standards need be used 64, 16 and 2 units per ml. The standard curves made from day to day should be parallel or nearly so.

It must be emphasized that the standards should be set up together with the unknowns, for each bottle of agar used. The graph is drawn from the standard readings, and the squares of the unknowns are read off as logarithms of the concentration of streptomycin per ml., then converted to units per ml.

The zone of inhibition of growth is not directly proportional to the streptomycin concentration, e.g. the difference between 2 and 8 units is 2.6 mm.; and the difference between 32 and 64 units is 0.6 mm.; thence it is realized that the range below 64 units is the more accurate for the conversion of diffusion to the concentration of streptomycin. Any unknowns that are greater than 64 units should be diluted in phosphate buffer pH 7.8 accordingly.

Agar Concentration.—The ideal is to experiment with a batch of agar powder and discover the concentration which gives the greater difference between the diffusions of 2 and 64 units. The final percentage recommended in Mitchison's paper is 1.25 per cent;

this concentration with my agar allows a comparatively poor diffusion compared with a 1 per cent concentration, which gives a wider range of diffusion; and of course the weaker the agar the better the growth of the staphylococcus so that demarcation is facilitated in the deeper, more anaerobic zones, which in a 1.25 per cent concentration are scattered and the colonies are exceedingly small.

Thus with the higher concentration of agar there is slower diffusion of streptomycin so that staphylococcal colonies grow to a visible size before an inhibitory concentration of streptomycin reaches them. The depth of diffusion can be increased and the line of demarcation improved by refrigerating the tests for two hours before incubating them; but when the optimum concentration of agar has been found, this is not necessary, as the rapid diffusion reduces scatter of colonies to a minimum.

Optimum pH.—The optimum pH for diffusion and antibiotic activity of streptomycin is apparently 7.8, and this critical pH is necessary for the medium and buffer used for diluting the standard 1 per cent streptomycin, urine, etc.; C.S.F. and serum are usually alkaline enough without adjustment of the pH. Cresol red is a useful indicator for this particular pH range.

Diffusion Agar.—2.5 per cent nutrient agar—1 volume, this must be clear and free from phosphate or other precipitate. 2 per cent Evan's or Bacto peptone in distilled water—1 volume, adjust pH to 7.8 with cresol red as indicator using the tile method. i.e. a change from yellow to a dirty red colour.

For trial purposes increasing amounts of peptone water can be added to the agar volumes to estimate the optimum agar conc.

An indicator can be included in the medium without detrimental effects.

The final agar is bottled in 19 ml. amounts and autoclaved at 10 lb. for fifteen minutes.

Streptomycin-sensitive *Staphylococcus*.—Most strains of *Staphylococcus pyogenes* are sensitive to streptomycin. A standard strain can be obtained from the Collindale Laboratories.

Streptomycin Standard.—A 1 per cent solution of streptomycin is issued from Collindale every three months and all dilutions for use as standards for *diffusion technique* should be made by accurate pipetting using phosphate buffer.

Diameter of Glass Tubing.—Various diameters of glass tubing were tested in triplicate with the same concentration of streptomycin, and no discrepancy of zones was observed. The range of diameters was from 3 mm. through intervals of 0.1 mm. to 3.7 mm.

Concentrations Below 2 Units per ml.—Streptomycin concentrations between 0.5 and 2 units/ml. can easily be assayed by including 0.5, 1.5, unit standards with the usual set. A separate graph is made plotting the actual units of streptomycin against the square of the readings of the diffusion zone. The unknowns are then read as units per ml. The graph shows linear tendencies up to 4 units per ml.

Error of Method.—Mitchison claims that error up to 100 units per ml. to be 20 per cent. I have found an error of only 8.5 per cent up to 64 units per ml.

Technical Points Not Mentioned Above.—(1) Ensure that the agar has been cooled to 45° C. before adding staph. suspension and do not keep at this temperature for more than five minutes once inoculated.

(2) Withdraw Pasteur pipette slowly through foam on agar, otherwise a quick movement will cause foam to attach to pipette.

(3) Use plain heart broth for overnight culture of staphylococcus. Glucose broth reduces the number of viable bacteria due to acidity of fermentation.

(4) A wide bore pipette should be used to facilitate quick discharge of the medium into the tubes.

(5) The diffusion tubes are 3×60 mm.; sealed at one end. They are cleaned by washing out the agar by using a pipette and tubing attached to a water tap, followed by swabbing with a wire swab, washed out again with tap water and then distilled water. Shake out excess of water, invert in a beaker to dry. Sterilize in a tin in hot air oven. The tubes are not plugged.

Clinical and Other Notes.

EXERCISE MEDICAL BAMBOO

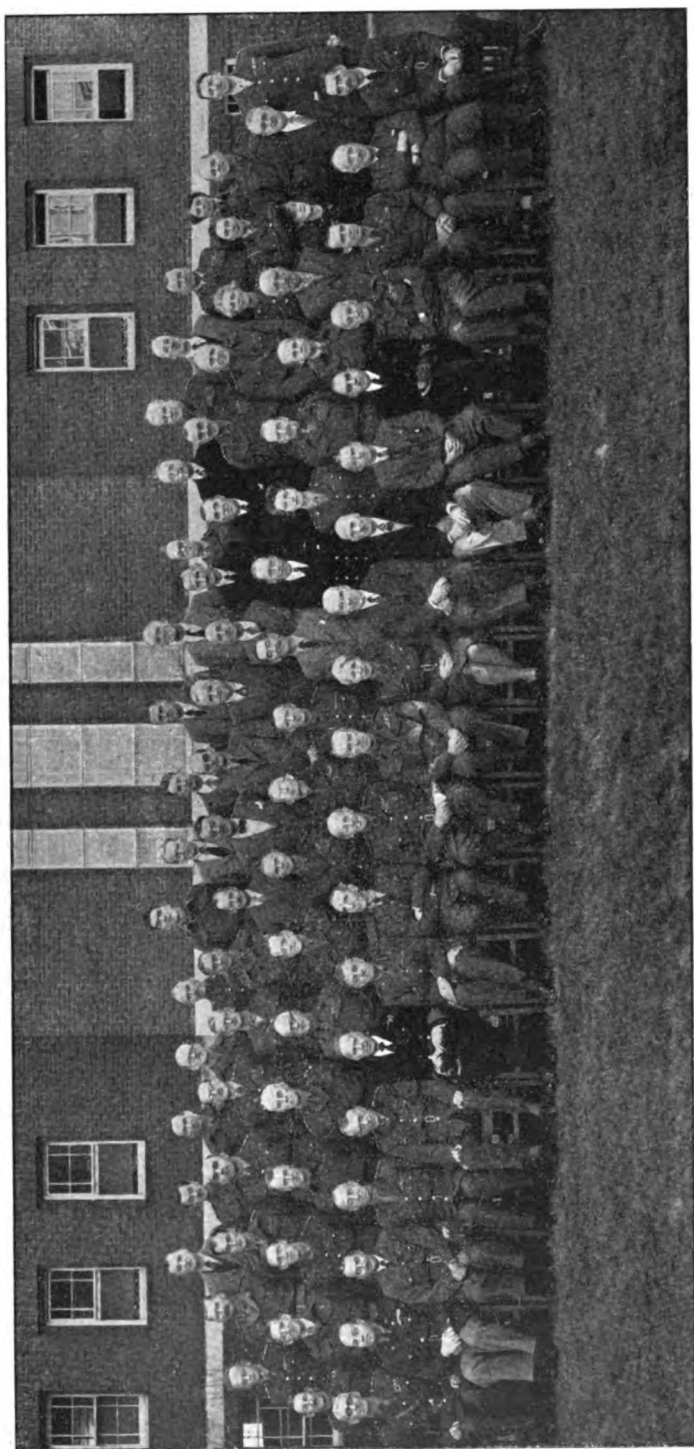
THE D.G.A.M.S. held a Medical Exercise, based on the C.I.G.S.'s Exercise BAMBOO, at the School of Hygiene, Mytchett, between November 17-20, 1948. Almost all the Senior Officers of the Corps in the United Kingdom and the Army on the Rhine attended. Representatives from the U.S.A.(M.C.), Navy, R.A.F., Q.A.I.M.N.S. and R.A.D.C. were also present. Some eminent personalities from the Civil profession who had been consultants in the Far East during the war were kind enough to attend and produced excellent papers on their particular subjects.

The "setting" of the exercise was in Northern Malaya and Thailand. The exercise itself fell to be divided into three parts. The first, the introduction included a "lead up" to the items chosen for presentation in the exercise proper by considering the latest developments in establishments and Hygiene, so that all present would be correctly launched into Battle. In the second, the exercise proper, the items chosen for discussion were put across by the presentation method, that is, by a series of playlets bringing out the points required and at the same time offering a solution. The third and final part, the professional aspects, with their problems, were brought out by a series of papers followed by discussion.

The D.G.A.M.S. is to be heartily congratulated on putting over in a very big way the first really big medical exercise ever sponsored by the War Office and one which may safely be classed as an outstanding success.

It is hoped that we may be able to publish some of the papers read during this Exercise in addition to any Official Report that may be issued by the Medical Directorate.

We are happy to be able to reproduce a group photograph of those taking part in this Exercise. Unfortunately space does not permit our printing the names of those who were present on this historic and memorable occasion.



MASSIVE AND GENERALIZED ŒDEMA OCCURRING IN TWO CASES OF LOBAR PNEUMONIA UNDER SULPHONAMIDE AND PENICILLIN THERAPY

BY

Lieutenant-Colonel JOHN MACKAY-DICK, M.B., Ch.B., F.R.C.P. Edin.
Royal Army Medical Corps
Officer in charge Medical Division of a British Military Hospital

Case 1.—An officer aged 41 years was admitted to hospital on January 7, 1949, with pneumonia of the right lower lobe and overlying dry pleurisy. He had first felt ill on embarking in England for B.A.O.R. on January 5, 1949.

On admission.—Temperature 102·8°, pulse 94, respirations 26. Appears mentally confused and gives a vague rambling history. It was felt that he was a candidate for delirium tremens. Glucose fluids were pushed and he was given 6 compound vitamin tablets daily for six days and then to have 2 tablets daily. There was hæmoptysis and, clinically and radiologically, there was consolidation of the right lower lobe. B.P. = 136/84. He was ordered sulphathiazole 5 grammes stat., 2 grammes four-hourly for the first twenty-four hours and 1 gramme four-hourly subsequently. Alkalies were given with each dose of this drug and instructions were given for him to drink 6 pints of fluid every twenty-four hours.

January 10, 1949: Temperature 102·2°; pulse 92; respirations 26. W.B.C. 16,550/c.mm.: polys. 84 per cent, basos. 1 per cent, lymphos. 11 per cent, monos. 4 per cent. Still mentally confused.

January 12, 1949: Temperature 101·8°; pulse 90; respirations 20. No apparent improvement. Mental confusion about the same. Stop sulphathiazole. Total 47 grammes. Commence penicillin 60,000 units stat. and 30,000 units three-hourly I.M.

Urine: No abnormal constituents.

January 13, 1949: Temperature 101·4°; pulse 84; respirations 18. Frequent loose stools.

Stool: No blood or mucus. No ova, cysts or *E. histolytica*. Culture: No pathogens isolated.

January 15, 1949: Temperature 100·2°; pulse 92; respirations 20. Face bloated. Eyelids puffy. Swelling of the arms, thorax and abdomen.

Difficult with fluids.

W.B.C. 25,000/c.mm.; polys. 94 per cent, eosinos. 2 per cent, lymphos. 4 per cent.

Urine: Acid. No albumin. No sugar. Deposit: W.B.C. Occasional epithelial cells.

January 16, 1949: Temperature 100·2°; pulse 92; respirations 20. Diarrhœa continues.

Stool: No blood or mucus. No cysts, ova or *E. histolytica* seen. Culture: *B. aertrycke* isolated. Kaolin 3 ii four-hourly.

Urine: Acid. No albumin. No sugar. Deposit: Epithelial cells and occasional W.B.C. Culture: Sterile.

January 17, 1949: Urine output in twenty-four hours, 33 oz.

January 18, 1949: Temperature normal and remained normal until January 25, 1949. Face bloated. Pitting œdema of thoracic wall, abdominal wall anteriorly and posteriorly. Pitting œdema over sacrum. No œdema of legs. External genitals normal. Marked breathlessness. Urinary output in twenty-four hours, 41 oz.

Examination of the chest reveals consolidation right lower lobe with numerous crepitations over the rest of the right lung and the entire left lung.

Stop penicillin. Total 1,680,000 units.

January 19, 1949: Marked breathlessness. CO₂ and oxygen administered by BLB

mask. External genitals now markedly œdematous. Pitting œdema of inferior extremities. Fluid intake restricted to one pint. Salt-free diet. 100 c.c. of 40 per cent dextrose I.V. Urine output in twenty-four hours, 47 oz. Blood urea 85 mg. per cent. B.P. 124/84.

Urine: S.G. 1010. Acid. No albumin. No sugar. Deposits: Numerous W.B.C. Occasional epithelial cells. Granular and hyaline casts seen. Ca oxalate crystals present. Chlorides: 1 gramme/litre.

R.B.C. 4,340,000/c.mm.; Hb 70 per cent; W.B.C. 14,300/c.mm.; polys. 80 per cent, eosinos 2 per cent, lymphos 17 per cent, monos. 1 per cent.

January 20, 1949: Much worse. Name on D.I. List. In view of the uræmia associated with œdema it was decided not to over-restrict fluids and so 50 oz. daily were given at the risk of increasing the extreme massive and generalized œdema.

Diet: 20 grammes of protein daily to maintain nitrogenous equilibrium. Bread, biscuits, butter, jam, marmalade, glucose, porridge and sugar. 100 c.c. of 40 per cent dextrose I.V. Deriphyllin-strophanthin 5 c.c. I.V. daily for four days.

Urinary output in twenty-four hours, 21 oz.

January 21, 1949: Condition worse.

Urinary output in twenty-four hours, 14 oz. for period ending 0800 hours.

Between 0800 hours and 1700 hours he had passed only 4 oz. of urine which now contained a cloud of albumin in addition to granular and hyaline casts and Ca oxalate crystals. B.P. 126/66. Venesection 200 c.c. at 1100 hours. Paracentesis abdominis, but only a few drops of straw-coloured fluid obtained. For a couple of days I had been toying with the idea that the massive œdema was due to a penicillin reaction and I decided to give Anthisan. This was started at 1700 hours. Dose: 2 tablets stat., one tablet at 2000 hours and 2200 hours, and then one tablet six-hourly. In the next fifteen hours he passed 19¾ oz. of urine and in each succeeding twenty-four hours there was a marked diuresis.

0800 hours January 22—0800 hours January 23: Urinary output 70 oz.

0800 hours January 23—0800 hours January 24: Urinary output 125½ oz.

0800 hours January 24—0800 hours January 25: Urinary output 70½ oz. Blood urea 75 mg. per cent.

0800 hours January 25—0800 hours January 26: Urinary output 94½ oz. Blood urea 40 mg. per cent. R.B.C. 4,250,000; Hb 80 per cent.

Residual slight pitting œdema around ankles. About midnight he was noisy and rambling. Anthisan stopped after 6 a.m. dose.

0800 hours January 26—0800 hours January 27: Urinary output 61 oz. Incontinent in bed through the night. B.P. 156/82.

0800 hours January 28: Urinary output 67 oz. Incontinent through the night. Blood urea 20 mg. per cent. Patient now to have a full diet with chicken and no fluid restriction. There is no trace of œdema.

0800 hours January 29: Urinary output 57 oz.

0800 hours January 30: Urinary output 49 oz. W.B.C. 13,400/c.mm.; polys. 75 per cent; eosinos. 4 per cent; lymphos. 19 per cent; monos. 2 per cent. B.P. 144/82.

0800 hours January 31: Urinary output 56 oz. He has a productive cough and the pneumonia is resolving. Since January 25, 1949, he has had low grade irregular pyrexia, but the temperature is now settling. Feeling very well and keen to get up.

January 31: Repeated specimens of urine show no abnormal constituents and the maximum S.G. 1018.

DIAGNOSIS

A case of lobar pneumonia, causal organism unknown, with a polymorphonuclear leucocytosis in the peripheral blood, *B. aertrycke* in the stool and which develops massive and generalized pitting œdema.

He was mentally confused on admission and it was felt that this might be

due to toxæmia or incipient delirium tremens the result of withdrawal of alcohol. Subsequently alkalosis was considered, but the urine remained acid. Sulphathiazole was considered and when he had 47 grammes without benefit this was stopped and penicillin administered.

What was the cause of the subsequent generalized and extreme pitting œdema and uræmia in this patient with no previous urinary symptoms, no history of previous renal disease, a normal blood pressure, no albumin in the urine until œdema present for some days and then only a little present, uræmia and granular and hyaline casts in the urine? All possible causes were considered and none of the usual causes was considered to be present.

Treatment for uræmia was given. However, I felt that there was extrarenal deviation of fluid and suspected penicillin might be the cause. Accordingly anthisan was given with the dramatic results already mentioned.

Case 2.—A boy aged 2 10/12 years was admitted to hospital on December 31, 1948. He had recently recovered from measles and had been febrile and off his food for the past three-four days. Temperature 102.4° F.; pulse 116; respirations 30. Clinically and radiologically he had consolidation of the right lower lobe. No sputum was obtained. W.B.C. 11,850/c.mm.; polys. 71 per cent; lymphos. 28 per cent; monos. 1 per cent. Urine: Acid. No albumen. Trace of sugar.

Treatment: Fluids ad lib. Sulphadiazine 1½ grammes stat. and ½ gramme four-hourly. Alkalies with each dose of sulphadiazine.

January 1, 1949: Hyperpyrexia (temperature 105° F.) and convulsions. Ears: NAD. Tepid sponged with benefit. Penicillin 200,000 units six-hourly I.M. ordered. On each succeeding evening he had hyperpyrexia and convulsions. Fluids and glucose were pushed. He was constipated. An enema was given and he had a small dose of mag. sulph. every morning.

January 5, 1949: Still febrile. Listless and unco-operative. Face bloated and body and extremities appeared swollen. Not taking fluids well and appeared to be passing little urine, a specimen of which was obtained and found to contain nil abnormal. He was still hyperpyrexial in the evening and having convulsions. During the day he had muscle twitchings. Sulphadiazine was stopped. Total 15½ grammes. Penicillin was also stopped. Total 2,600,000 units. 5 c.c. calcium gluconate 10 per cent given I.M. twice daily without benefit.

His mother was an Anglo-Indian and as it was not known if he had been in India blood films and thick drops were examined repeatedly for malarial parasites and quinine bihydrochloride gr. ii t.d.s. given without benefit.

The following investigations were also carried out and found to be negative.

Blood culture, urine culture, stool culture.

Agglutination reactions for enteric group fever *B. abortus* and *melitensis*.

Penicillin 30,000 units I.M. three-hourly was started again on January 7, 1949, but was quickly stopped on January 9, 1949, when he showed much mental confusion and constant muscle twitchings. His face was bloated, his eyelids swollen, his trunk and extremities markedly swollen and marked œdema of his genitals. He would not swallow fluids and and his throat was found to be markedly œdematous with superficial ulceration. A throat swab revealed no predominant organisms. He was passing very little urine. It was now felt that the generalized and severe œdema was due to penicillin and this was stopped on January 9, 1949. Anthisan ½ tablet was now given and ¼ tablet six-hourly ordered with really dramatic effect.

The child began to pass large quantities of urine in twelve hours and for the next few days he was constantly in a wet bed. Within 24 hours of the exhibition of the

anthisan he began drinking well and his general condition rapidly improved. All traces of œdema were gone in two-three days and he became happy, cheerful, playful and co-operative. There was no obvious effect on the temperature which became normal on January 15, 1949, and has remained normal.

Before the significance of the œdema was appreciated we considered hyperpyrexia, alkalosis pneumotypoid, malaria, etc., as possible causes for the convulsions, muscle twitchings, apathy and mental confusion.

These days, as already reported in a recent editorial in the *B.M.J.*, some pneumonias with a polymorphonuclear leucocytosis in the peripheral blood do not show the anticipated improvement with sulphonamide therapy and so we are apt to exhibit penicillin as well as these drugs are believed to have a synergic action. We have felt that the cause for this delayed improvement is probably the result of a virus infection in the first place with a varying bacterial infection superimposed.

It would be ideal to isolate the predominant organism in the sputum in all cases of pneumonia and test its sensitivity to penicillin and sulphonamide and exhibit the appropriate drug, but this is not always feasible. It is also wise to test for the presence of cold agglutinins and evidence of "Q" fever, etc., in doubtful cases.

I suggest that the generalized and extensive œdema in each case was essentially the result of extrarenal deviation of fluid due to penicillin hypersensitivity. I can find no other explanation acceptable in these two cases except the possible association with a sulphonamide.

It is possible that the excessive dosage of penicillin in the case of the child predisposed to the generalized œdema in that case.

The dramatic, and probably life-saving, effect of anthisan in each case is worthy of record. I have never seen or heard of such massive and generalized œdema due to penicillin hypersensitivity.

In view of this experience I feel that in cases of œdema, especially in cardiac or renal œdema where a sudden increase of œdema might be most dangerous, it would be better to use an appropriate sulphonamide rather than penicillin in cases where the organism is sensitive to both penicillin and sulphonamide and that dual therapy should be exhibited only after careful thought.

Furthermore, I would suggest that if, in an appropriate case, in the absence of complications due to the disease present and in the absence of another infective disease process, the expected response to penicillin therapy does not materialize, then the continued use of the drug should be reconsidered instead of continuing the drug hoping for the best.

The penicillin used was: Penicillin—Sodium Salt Glaxo. The patients were treated in different wards and numerous other patients were receiving the same penicillin at the same time.

I present these notes for publication for two reasons:

(1) The appearance of generalized and massive œdema during the course of sulphonamide and penicillin therapy.

(2) The dramatic and probably life-saving effect of anthisan in each case.

ACKNOWLEDGMENTS

Major-General F. R. H. Mollan, *O.B.E.*, *M.C.*, *D.M.S.* British Army of the Rhine for permission to publish these notes. Colonel J. B. George, Commanding a British Military Hospital *B.A.O.R.*, for permission to forward these notes for publication. Lieut.-Col. A. B. Dempsey, *F.R.C.S.Eng.*, *R.A.M.C.* and Lieut. G. Freeman, *R.A.M.C.*, for help with these cases. Lieut.-Col. R. L. Townsend, *R.A.M.C.*, for the laboratory investigations. Miss Maureen Gara, *Q.A.I.M.N.S.(R)*, Miss P. O'Sullivan, *Q.A.I.M.N.S.(R)* and Miss Arrowsmith, *Q.A.I.M.N.S.(R)*, for their skilled observations and care of the patients. The anthriscan tablets were kindly supplied free of charge for clinical trial by May & Baker (Ltd.), Dagenham, England.

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- CRAIG, JOHN, CLARK, N. S., and CHALMERS, J. D. (1949) *B.M.J.*, January 1, pp. 6 - 9.
 HUNTER, R. B., and DUNLOP, D. M. (1948) *The Quarterly Journal of Medicine*, **17**, No. 68. October, pp. 271 - 290.

 Obituary

Major-General C. W. F. MELVILLE, *C.B.*, *I.M.S.*

WE regret to record the death of Major-General Charles William Francis Melville of the Indian Medical Service, in the Queen Alexandra Military Hospital, Millbank, on April 14, 1949. He had been in failing health for some time but had retained his essential cheerfulness and charm of manner. In the end his death came suddenly, from a heart attack, and he was spared any long-drawn painful illness.

Charles Melville was born in Edinburgh in 1877, one of a large family to bear and honour a well-known Scottish name.

He qualified in Edinburgh and passed into the *I.M.S.* taking first place in the entrance examination and, further, first place at the conclusion of the *L.O.P.* course at Netley.

By far the greater part of his service was spent in the Punjab, mostly at Lahore where for many years he was the medical officer of Hodson's Horse. Only a few days before his death he had said what happy days those were and how he had always kept up his close connexion with that Regiment.

He was a man of outstanding intellectual ability with a very extensive and sound knowledge of medicine. At times inclined to philosophic speculation he was never out of touch with the practicalities of medicine. He was, for a time, Professor of Anatomy, as well as of *Materia Medica*, at the Grant Medical College at Lahore.

During his years in the Punjab—both before and after the 1914–1919 war when he served in the Medical Directorate at Army Headquarters and later commanded a Field Ambulance in Palestine—he became the friend and confidant of many an R.A.M.C. officer. Later he was an A.D.M.S.; again, at Army Headquarters; and finally he was D.D.M.S. of the Eastern Command at Naini Tal.

In this, his last, appointment he became known to a wider circle of R.A.M.C. officers many of whom, especially his staff in immediate personal contact, came to value his exceptional gifts. His quiet efficiency, personal interest in the well-being of all ranks and never-failing charm of manner made him many friends.

Charles was widely read with an extensive and Catholic appreciation of English literature. A regular reader of *Nature* his scientific knowledge could, at times, be disconcerting. He had a very wide circle of friends and was always a good companion and a perfect host. Even during a Punjab hot weather his debonair urbanity never deserted him.

He had lived in an interesting age in the Punjab and knew it better than many. In conversation with him one often felt that the pages of Kipling were being brought to life. He could, on occasion, be persuaded by close intimates to tell how he, also, had seen the phantom rickshaw on the Mashobra road.

His unique knowledge of the Punjab was equalled by his understanding of, and sympathy for, the Indians, many of whom held him in very high esteem.

It is but fitting that, in his passing, we should pay this small tribute in our pages to this charming personality who was so intimately connected with our Corps as an administrator as well as the trusted friend, confidant and mentor of so many of us individually.

Notices

THE ANNUAL DINNER

OF THE REGULAR OFFICERS OF THE ROYAL ARMY MEDICAL CORPS

past and present, including officers holding Short Service commissions, will take place on Friday, June 24, 1949, at the Connaught Rooms, Great Queen Street, Kingsway, London, W.C., at 7.30 for 8 p.m.

The Director-General Army Medical Services will preside.

It is requested that early application for tickets be made.

The cost of the Dinner will be 17s. This includes 3s. to meet overhead charges such as printing, service charges, postage, etc. A cheque for 17s. should accompany the application.

Wines, spirits, etc., will be extra and will be paid for at the table by those ordering them.

Dress.—Dinner Jacket or Service Dress.

(Decorations and miniatures will not be worn.)

Applications for tickets should be made to the Hon. Sec., R.A.M.C. Dinner Committee, 84, Eccleston Square, S.W.1.

Separate tables, to allow ten officers to sit at each, will be reserved for parties of ten officers who wish to dine together if they will arrange to notify the Hon. Sec. before June 1, 1949.

After this date officers who have not arranged their seats will be allotted to tables by the Dinner Committee.

NOTICE

“WANTED good-quality sporting and athletic equipment. Anyone who has any article of sports equipment, such as a cricket bat, or cricket pads, in really good condition, should write to the address given below, giving full details and the price required; at the same time, forwarding the item for sale.

“The article will be placed on sale in the Second-hand Shop and at the end of three months the article/s will either be returned—not having been sold; or the price required will be forwarded—if this has not already been done.”—Major H. A. Havilland, *M.B.E.*, Quartermaster, The Warren, R.M.A. Sandhurst, Camberley, Surrey.

PRIZE COMPETITIONS, 1949

THE Council of the Royal Sanitary Institute have announced particulars of the prize essay competitions for 1949. Three prizes are offered: the John Edward Worth Prize of £40 for an essay on practical improvements of appliances or inventions used or proposed to be used in or about dwelling houses; the John S. Owens Prize of £15 for an essay on the ventilation of dwellings and its effect on human health; and the Henry Saxon Snell Prize of fifty guineas for an essay describing suggested improvements in the construction or adaptation of sanitary appliances.

Intending competitors should apply to the Royal Sanitary Institute, 90, Buckingham Palace Road, London, S.W.1, for a copy of the general conditions.

NEW DRUG FOR FILARIASIS

BURROUGHS WELLCOME & Co. announce the issue of “Banocide” brand Diethylcarbamazine, a synthetic non-metallic compound (1-diethylcarbamyl-4-methylpiperazine citrate) with specific chemotherapeutic activity *in vivo* against many types of filarial parasites, particularly *Wuchereria bancrofti* and *Onchocerca volvulus*. “Banocide” is administered orally in the form of 50 mg. compressed products, is well tolerated and causes rapid disappearance of microfilariae from the blood. This new filaricide is issued in containers of 20, 100, 1,000 and 5,000 products. Further information is available on request from Burroughs Wellcome & Co., 183–193, Euston Road, N.W.1.

Review

THE NATIONAL FORMULARY 1949. Published by the British Medical Association and the Pharmaceutical Society of Great Britain, London. Pp. 128, $6\frac{1}{2} \times 4$ in. Price 2s. 6d. post free. Interleaved copies 4s. post free.

On May 1, 1949, this publication will replace the National (War) Formulary 1947 which at present forms the basis of prescribing in military hospitals, thereby obviating any necessity for acquaintance with separate pharmacopœial systems in military and civil life. The advantage under conditions of short service staffs of medical officers and pharmacists in the Army which will be obvious, and much economy of money and labour will be effected by adherence to the field of prescribing which it offers.

The new work incorporates much information which will be found to merit careful study. This includes:

Notes for Prescribers: Information on the pharmacology and therapeutic uses of barbiturates, hormones and sulphonamides; an account of the use of liver preparations in the treatment of the anæmias; the types and uses of enemas.

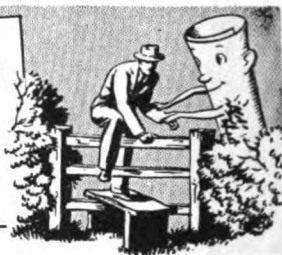
Prescriptions for Dangerous Drugs and Schedule IV Poisons: The legal requirements for prescriptions for Dangerous Drugs and for Schedule IV poisons and the conditions under which these prescriptions may or may not be repeated.

General Notices: General instructions to the users of the Formulary on the interpretation of the formulæ, doses and symbols.

Appendices: Tables are given of metric and Imperial equivalent weights and measures and of approximately equivalent doses in the two systems; a chart indicates the labelling and identification colours of medical gas cylinders; there is a list of over 300 proprietary preparations with the name of the drug or preparation which is substantially identical or of reputed analogous therapeutic effect.

The binding is in green linen-covered boards with rounded corners and the book is of convenient size for carrying in the pocket or keeping ready at hand, and for the role of a medical officer's vade-mecum which it can be expected with confidence to fulfil.

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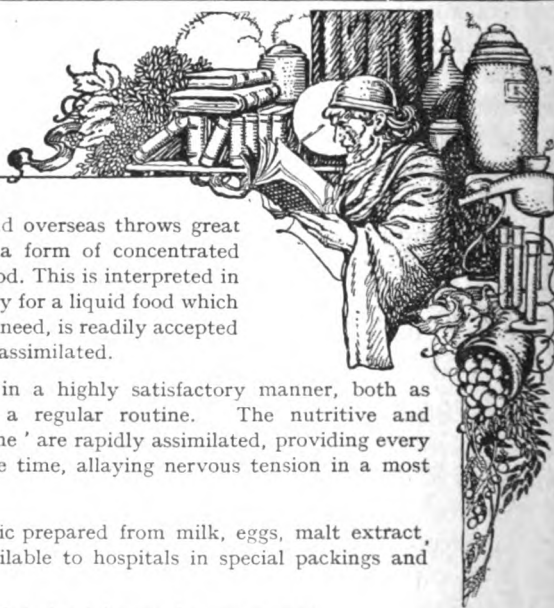
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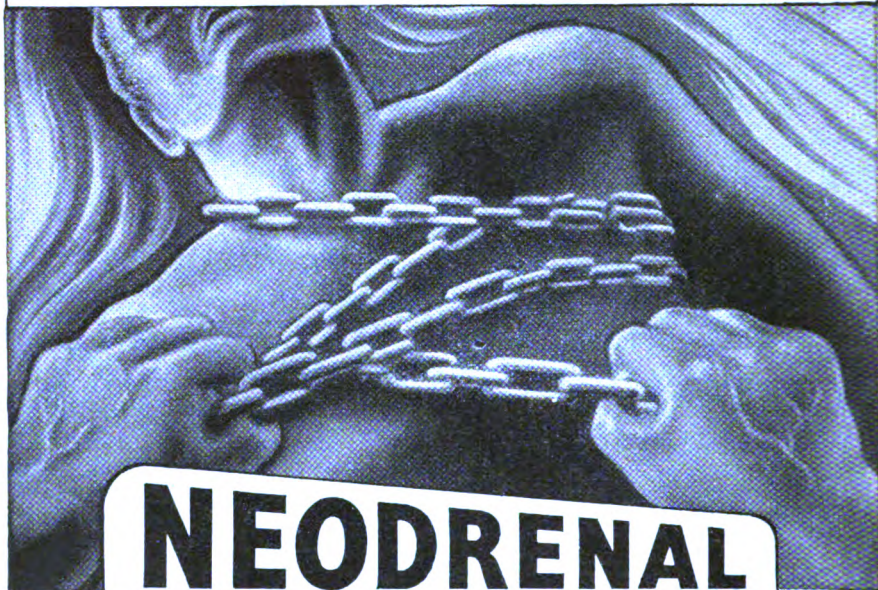
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Journal of the Royal Army Medical Corps.

Echoes of the Past

SIR JAMES McGRIGOR was Director-General of the Army Medical Service from June 30, 1815, to February 6, 1851—a period of thirty-five years and eight months. He was described as “Director-General with relative rank of Major-General at a salary of £2,000 a year”—which, in those days, might be regarded as not-inadequate remuneration.

We may wonder, if it ever occurs to us to think about the first half of the nineteenth century, what this man was like who held this position for so long.

Among the documents captured when the Allies overran Heligoland at the close of the last war was found a Directive, issued on November 20, 1816, signed by James McGrigor, Director-General and W. Franklin and W. Somerville, Principal Inspectors. We have thought it only fitting to publish this Directive which is of interest as throwing some light on conditions nearly a century and a half ago. That it should have survived so many years in the Archives of Heligoland gives added interest. There are some remarks in it which might well have been written at a later date but the actual date is 1816.

ARMY MEDICAL BOARD OFFICE, 20th NOVEMBER, 1816

IN order to remove the very great inconvenience resulting from the Returns of Sick being dated at different periods by different Medical Officers, as well as from the discordant and various terms used in the Nomenclature of Diseases, we find it expedient to direct that in future all Returns of Sick shall be dated on the 20th of the month, whether half-yearly, quarterly or monthly.

A nosological form of arrangement is enclosed, to which the strictest adherence is required in ordinary cases, and a deviation from that nomenclature will only be admitted under the most urgent circumstances, such as the statement accompanying the Return shall justify; since almost every disease incident to a Soldier is comprised in it. We are confident that the Medical Officers of the Army, however strongly they may lean to particular doctrines or hypotheses in the classification or nomenclature of diseases, will at once see the necessity of conforming to some established standard, and be accordingly disposed to make some sacrifice for the sake of uniformity.

In exacting this, we must beg it to be clearly understood, that we shall receive with particular satisfaction such observations and opinions as the Officers may favour us with,

and in these the fullest scope may be taken ; and they may be assured that all Returns, Statements of Disease and in general every Medical Record will be open to their inspection at this Office whenever they may wish to see them.

Hereafter no diseases will be inserted in the printed forms that may be sent to Medical Officers, the number of columns required in each Return will be entirely according to the number of different diseases that may occur during the period, following strictly the order observed in the Return of nomenclature herewith sent ; the observations accompanying the Return to be written on foolscap paper, and with a margin to admit of binding.

The diseases of the eye, with the particular morbid affections of it, and the various diseases of the skin are much too numerous to be entered in separate columns in the body of a Return, the aggregate number of them only may be entered ; and the Medical Officer will add a separate sheet to the Return, with such number of columns as may be required to admit the varieties of these diseases (this has principally reference to the half-yearly Return). A Form is transmitted to Foreign Stations for diseases of the first class, and the nomenclature and subdivisions of Willan and Bateman, are suggested for the second. To the Medical Officers at home the recent publications on diseases of the eyes, and particularly the 2nd edition of the work of the late Mr. Saunders edited by Dr. Farre with Dr. Bateman's compendium of the late Dr. Willan's labours, will be the surest guide to a correct nomenclature.

It may not be here superfluous again to call to the recollections of the Medical Officers some directions formerly sent to the heads of departments employed on Foreign Stations, and to Regimental Medical Officers at Home.

By our Letters of December 6, 1815, and May 8, 1816, we called for half-yearly Reports from these Officers, for the purpose of being put in possession of a full historical and connected detail of the diseases incident to the troops during these periods. Although many of these Reports have answered our expectations, we believe that the object we had in view has not always been understood.

In these Returns we wish to see embodied all the occasional observations on diseases that may have been made as well by Regimental Officers, by whom they are expected to be entered in their Registers, and from time to time transmitted to the senior Officer on the Station, as by the senior Officer himself, whether these relate to the prevalence or variety of disease—its causes—its symptoms—its treatment or prevention. Whatever relates to the natural history and medical topography of the Station, the variations of temperature, and other meteorological observations, the discipline of the troops as relating to their health, are all subjects legitimately belonging to science and military medical science in particular. Much assistance in prosecuting some of these enquiries may be derived from cultivating the acquaintance of practitioners in civil life, which is recommended to the attention of the Military Medical Officer.

A clear statement of the due proportion of the respective diseases both as to frequency and mortality, should not be omitted in these Returns.

These subjects have not always attracted the notice they merit, but we cannot too strongly recommend them to the serious attention of the Medical Officers, and we rely with confidence that the assistance, counsel, and authority of the heads of departments and senior Officers of Regiments, will not be wanting to second our endeavours.

We wish it to be clearly understood by all ranks, that labours of this kind will be duly appreciated by us, and pointed out to the favourable notice of the Commander-in-Chief.

The preservation and preparation of morbid parts, is another subject to which we directed the attention of the heads of the departments abroad, in our Letter of August 7, 1816, when we trust our views were sufficiently explained. We now call the attention of Regimental Surgeons at home to this important duty, and as considerable progress has been made in collecting morbid and anatomical preparations from the General Hospitals both at home and abroad, we are desirous of augmenting their number by the assistance of the Regimental Officers. We direct therefore that no opportunity in future be lost of preserving in spirits, or making drawings (where the means of preparation are

It is expected Medical Officers pay particular Attention to a correct Discrimination of Diseases, in forming their judgment of them, and be careful in classing them accordingly, with due nosological Arrangement, particularly with respect to Acute Diseases. In Diseases of the Skin, it would be more desirable that the Arrangement of Dr. Willan be made use of. The Medical Board expect that this Injunction will invariably be kept in Mind by Medical Officers ; and when any Deviations are made from it, or from the Form now established, that they be supported by the most respectable Medical Authorities, which at all Times will be attended to by the Board.

Cases must be inserted Acute or Chronic, as they happen to be, when first borne upon the Return ; and afterwards, when Diseases admitted Acute become Chronic, the number in the latter Stage, being included in the Total of that Disease, must be mentioned in a Note.

Sick in Barrack or Quarters must be included in the Admission and Discharge as well as those in Hospital.

The Board likewise desire that the Returns shall always be filled up by a Medical Officer, whether it be the Chief Surgeon or Physician himself, or one of the Assistants ; and that when the Blank Forms are expended, Paper be ruled for the Purpose, till others can be sent from the Board Office.

Under the Observations and Reports is to be comprehended such Information on individual Cases, or prevailing Sickness, as may appear to be useful or necessary for the Elucidation of their Nature and Cause, and also a Report of all such Occurrences, relating to the Sick and Hospital Affairs, as have taken place since the preceding Return.

The Return to be signed by the Senior Medical Officer present, and the Names of the other Medical Officers to be inserted at the Bottom, stating whether they be present or absent, and if absent, by whose Authority, and on what Account.

[EDITORIAL NOTE.—*It is unfortunate that the “ Nosological form of arrangement ” said to be enclosed does not appear to have survived the passage of time. This official Nomenclature would be of great interest—doubtless it was simpler than that in use today—and should a copy be discovered the Editor would be grateful for an opportunity of reproducing it.*]

Original Communications

IN LIGHTER VEIN

BY
DOADE

THE GRADED SPECIALIST

"A SOCIALIST," writes H. L. Mencken, "is simply a man who is suffering from an irresistible compulsion to believe what is not true."

The same might be said of a Graded Specialist—though in his case the compulsion is more subtle, and, being linked to a perverse love of calamity for its own sake, is the more to be deplored.

The chances are you are averagely healthy but five minutes with a Graded Specialist will convince you that you are nothing but an obscure symptom-complex (whose appeal is enhanced rather than diminished by its extreme rarity). The diagnosis is the thing: and, after you have been triumphantly labelled "Rénon-Delille Syndrome" or "Von Recklinghausen's Disease," your case is closed as far as the investigator is concerned. The ensuing chapters of your story, with their anticlimatic insistence on treatment, are as uninteresting as the pale afterglow of a detective yarn . . . the leisurely elucidation of the evidence by a suave and competent sleuth after the murderer has been carted off to the penitentiary.

True, prevention may be better than cure; but eliminate disease and you deprive a considerable section of the community of both livelihood and *raison d'être*.

Speaking generally, you will find the surgeon less inclined to be a prophet of woe than the physician. After all, if the worst comes to the worst, it is he who has to get busy, whereas his medical colleague may only stand by with folded hands and downcast eyes. Substitute a pancreatico-duodenal fistula for a simple appendix and you will get few plaudits from the tummy-plumber, whose love of the spectacular is tempered by a very natural distaste for hard work. But a medical specialist, hot on the trail of Baumgarten-Cruveilhier cirrhosis or Queyrat's erythroplasia, has no such vulgar inhibitions; nor will he thank you for the suggestion that his patient's disorder is "functional."

Few spectacles in our human drama have the compelling charm of a physician lusting after a rare disease: and if a simple explanation looks like ousting his cherished diagnosis, he will only yield its validity inch by inch, and with obvious reluctance. For a spell thereafter he may even be quite a good doctor.

Of all the graded specialists, surely none is more picturesque than the oto-

rhino-laryngologist who combines the passionate dogmatism of a Marxist philosopher with the persuasive cunning of a bulldozer. Tonsillectomy is his religion, and human sacrifice its inevitable corollary, wherein the complacent cluckings of the operator mingle with the restrained roars of the patient in unholy communion.

Ascending the social scale somewhat, we pause to consider the graded anaesthetist, poised perilously on his tin throne. Persistent prayer has given him an occupational kyphosis, and, alone among the graded specialists, he has the power to endanger life. This invests him with a spurious importance and gives him ideas beyond his station. (Some graded anaesthetists have even been known to argue with the coroner!)

In this speciality, promotion to full specialist status is truly a case of the survival of the fittest . . .

Drifting into the Skin Department, we may see the Graded Dermatologist unctuously prescribing his innocuous unguents in an atmosphere of patient hopelessness. He has as many names for his stock-in-trade as you will find in a seedsman's catalogue—"Erythema Iris . . . Leucodermia . . . Cheiropompholyx." How trippingly they roll off the tongue!—and one gathers that his flair for onomatopœia stems from a subconscious desire to compensate his patients for their scrofulous exteriors.

Honest fellow! He cannot easily exchange his mediæval lore for the "rational therapeutics" of the modern world.

Homogeneous culture is all very well in its way, but the Tropical Medicine enthusiast (whom God preserve) exhibits in the pursuit of his hobby a singleness of purpose verging on bigotry. Armed with "shuftiscope" and syringe, he will purge, prod and probe you in a vigorous but unrewarding search for what is manifestly not there. Once you have entered the Tropical Wing you might as well bow gracefully to the imputation that you must have had malaria (or was it dengue?) sometime; that your liver and lights are positively riddled with cysts; and that nothing short of a regime of graduated poisoning can save you from dissolution. This mortification of the flesh is probably a legacy from the brave days of missionary enterprise, when the cause of evangelism was seen to be best served by a brisk purge or a good going-over with chaulmoogra oil!

Let it not be imagined from all this that I am in any sense critical of the graded specialist. In fact he is often quite a nice young man, who dresses well and smells agreeably of hair unguents and bath-salts. And if he has perhaps an unfortunate tendency to overrate obvious trivialities and a boyish relish for "detection, mystery and horror," who am I to say him nay?

After all, just as dustmen, dockers and drysalters serve the community in their various ways, so may the graded specialist prove to have a place—aye, and a not unimportant place—in the social structure of our country.

MILITARY SURGERY IN THE SIXTEENTH CENTURY

BY

DAVID STEWART

THE ancient Greeks expected clean wounds to heal by first intention without the formation of pus, and without any inflammatory reaction. They treated such wounds by washing them with pure boiled water, or with wine, and dressed them with clean cloths. The Roman surgeons treated wounds in a similar manner and got equally good results.

Towards the end of the Roman Period the standard of surgical treatment deteriorated greatly; and the "Dark Ages" which followed were dark indeed for medicine and surgery. By now a new doctrine had crept into surgical practice, which maintained that no wound would heal satisfactorily without the formation of "laudable" pus. Who originated this pernicious fallacy is uncertain; the Arab surgeons, who had such a remarkable influence upon European surgical thought in the eleventh century, claimed that Galen was the discoverer, but this is probably not entirely correct. This, however, is certain: that whoever first enunciated this thesis was responsible for causing a large amount of unnecessary human misery extending over many centuries. Indeed, the doctrine of laudable pus was only shown to be completely erroneous less than one hundred years ago, when Lister established the theory of the antiseptic treatment of wounds, and demonstrated that suppuration was merely the reaction of the body tissues to uncleanness and bacteria.

It is true that some early surgeons fought against this suppuration hypothesis, and supported the old Greek view that if a wound is kept clean it will not suppurate; but such men were looked upon as heterodox and unsound. In the thirteenth century Theodoric de Mondeville put up a gallant struggle for clean surgery but, unfortunately for humanity, lost the battle. His views were overwhelmed by the teachings and professional reputation of Guy de Chauliac in the following century. This great surgeon poured scorn upon the views of Theodoric, and declared that the formation of pus was absolutely essential for the proper healing of wounds. So highly was Guy esteemed that this remained the orthodox doctrine for some five hundred years.

Guy is of further interest because he gave a classification of the different schools of surgeons in the fourteenth century, which clearly shows the importance attached to the question of the formation of laudable pus in the treatment of wounds. Guy said that there were five sects of surgeons. The first, the one to which he belonged, followed Roger and Roland, and applied poultices to all wounds. The second followed Theodoric, and only applied wine to wounds. The third group followed Salicet and Langfranc, and healed wounds with ointment and soft plasters. The fourth were chiefly German army surgeons, who used charms, potions, oil, and wood. While the last

were old women and ignorant people who, in all cases, resorted to the saints (Ana., pp. 228-9).

My old friend Harvey "Graham," commenting on this classification of Guy's in his delightful book "Surgeons All," says: The first group were those who deliberately applied salves which would produce suppuration. The second were the quite unorthodox few who tried to heal wounds by first intention. The third held an intermediate position between the first two groups. The fourth relied upon charms and incantations, possibly assisted by the odd cabbage leaf. The fifth group sat back and did nothing except to rely upon the will of God. He goes on to say "Unhappily a comparison of the results of treatment by these five different methods was never undertaken. If it had been, Theodoric and his followers would almost certainly have headed the list, with the 'women and silly folk' a close second" (p. 110).

In the later fifteenth century the extended use of gunpowder brought new complications for the military surgeon, and added gunshot wounds to his practice. Unfortunately the earlier doctrines as to the pathology of these injuries were erroneous, and were the cause of much needless suffering to the unfortunate soldiers who happened to receive gunshot injuries. The men responsible for this state of affairs were Jerome of Brunswick and John of Vigo, who taught that these wounds were poisoned by the gunpowder, and scorched by the heat of the bullet. To counteract the effects of the heat and the poison they declared that cauterization was necessary; and this could best be done by pouring hot oil into the wound.

Fortunately for the wounded, during the sixteenth century there lived one of the greatest surgical geniuses of all time—Ambroise Paré. This noble man refused to accept the views of his predecessors before he had satisfied himself of their validity; and he strived continually to reduce the amount of unnecessary pain that the wounded soldier had to endure. His fame reached to such an eminence that his presence with an army was considered to be as valuable as a reinforcement of several thousand men. When he appeared in a camp or garrison, it was not uncommon for the soldiers to turn out and cheer him on his arrival.

By a happy chance, Paré, early on in his career, discovered that Jerome and his followers were entirely wrong in believing that bullet wounds were, from their very nature, of necessity poisoned, and that they required vigorous treatment by cauterization to ensure that they healed. The incident in question happened during Paré's first campaign when he was a young man, fresh from his early training in Paris, and still a little unsure of himself and his capabilities. How this discovery came to be made may best be described in his own words from his "Apology" as translated by Packard:

I had not yet seen wounds made by gunshot at the first dressing. It is true that I had read in John de Vigo, the first book, "Of Wounds in General," chapter 8, that wounds made by firearms participate of venomosity because of the powder, and for their cure he commands to cauterise them with oil of elder, scalding hot, in which be mixed a little theriac. And in order not to err before using the said oil, knowing that such a thing would bring great pain to the patient, I wished to know first, how the other surgeons did for the first dressing, which was to apply the said oil as hot as possible into the wound

with tents and setons, of whom I took courage to do as they did. At last my oil lacked and I was constrained to apply in its place a digestive made of yolks of eggs, oil of roses, and turpentine. That night I could not sleep at my ease, fearing my lack of cauterisation that I should find the wounded on whom I had failed to put the said oil empoisoned, which made me rise very early to visit them, where beyond my hope, I found those upon whom I had put the digestive medicament feeling little pain, and their wounds without inflammation or swelling having rested fairly well throughout the night; the others to whom I had applied the said boiling oil I found feverish, with great pain and swelling about their wounds. Then I resolved with myself never more to burn thus cruelly poor men wounded with gunshot (pp. 162-3).

Military surgery owes to Paré another debt for a further discovery which he made in this field of medical endeavour. He introduced the ligature to control hæmorrhage after the amputation of a limb. Prior to this bleeding had been checked by cauterizing the divided blood-vessels.

The sixteenth century is peculiarly rich in textbooks of military surgery, and we Britons may well be proud of the contributions made at this time by our fellow countrymen to this subject. No less than four of them during this century published works on the treatment of wounds, three of them were Englishmen and one a Scot, so that for the first time in this series of papers we can legitimately refer to our medical officers as British, thereby foreshadowing their descendants in the British Army of later days.

The first of these authors was Thomas Gale (1507-87), who received his surgical training in London. He saw active service in the campaigns of 1544 and 1557, and afterwards became an eminent London practitioner. In 1561 he was master of the Barber Surgeons Company. He was the author of "The Institution of Surgery," published in 1563, and "A Brief Declaration of the Worthy Art of Medicine," and "The Office of a Chirurgeon," published in 1566 (D.N.B., xx, p. 378).

William Clowes (1540?-1604) was of Warwickshire extraction, and also received his early training in London. He was on active service in the years 1563 and 1585, and may have served in the Fleet against the Armada. He was on the staff of St. Bartholomew's Hospital, and towards the end of his life was appointed Surgeon to the Prince of Wales. He was the author of (1) "De Morbo Gallico," 1579. (2) "Proved Practise for All Young Surgeons," 1591. (3) "A Treatise of the French or Spanish Pox," 1591—a new edition of (1). (4) "A Profitable and Necessary Book,"—a new edition of (2). (5) "A Right Fruitfull and Approved Treatise for the Artificial Cure of the Struma," 1602. In 1637 reprints were published of his works (D.N.B., xi, p. 132).

John Banester (1540-1610) saw service in the French campaign of 1563, and served at sea in 1585. He had been in practice in Nottingham, but after his naval experiences settled in London. He was the author of "Antidotarie Chirurgicall," 1589, and "A History of Man." A collected edition of his works was published under the title of the "Workes of the Famous Chyrurgyan, Mr. John Banester," in 1633 (D.N.B., iii, pp. 118-9).

Peter Lowe (1550-1612?) was a Scot. As a youth he left his native land and studied surgery in Paris, and afterwards practised in France and Flanders. Later he had several years' experience as a military surgeon in the French

service. He then returned to Scotland and settled in Glasgow, where he was responsible for the founding of the Faculty of Physicians and Surgeons in that city. He was the author of (1) "The Spanish Sickness," 1596. (2) "The Whole Course of Chirurgie," 1597. Further editions of the latter work were published in 1612, 1634, and 1654 (D.N.B., xxxiv, p. 196).

To this list the name of Woodall (1556?-1643) must be added, for though he did not publish anything until the following century, he is essentially a sixteenth century man. Like Clowes, he was of Warwickshire stock. He served as a regimental surgeon in 1591, and afterwards travelled and lived abroad. In 1599 he was admitted to the Barber Surgeons Company, and was the Master of that Company in 1633. He was Surgeon-General of the East India Company, and was also head of the medical services of the Army and Navy. He was the author of the "Surgeon's Mate," published in 1617, and of "Viaticum, or the Pathway to the Surgeon's Chest," 1628. He republished enlarged editions of his works in 1639 (D.N.B., lxii, pp. 382-3).

From this brief survey it will be seen that there is a large amount of material available, to enable us to obtain a fair idea of the methods employed in the treatment of wounds during the period under discussion.

In small simple incised wounds the treatment was largely left to Nature. The edges of the wound were brought together and retained in position by means of a dressing of tow thoroughly impregnated with white of egg, which was applied to the surface of the injury. The wound was then covered with a roller bandage, and not interfered with for several days.

If the injury was larger and deeper, so that its edges could not be retained in apposition by these simple means, it became necessary to insert sutures to bring the edges and sides of the wound in contact with each other. The suturing was done as follows: the first suture was inserted at the mid-point of the wound, the second stitch was placed at a finger's breadth from the first, and the third was placed at a finger's breadth from the first suture, but on the side opposite to the second; further stitches were inserted, as required, on alternative sides of the first suture, and at a finger's breadth from each other, until the whole length of the wound had been closed. Care was taken, before the suturing commenced, to remove any foreign bodies that might be concealed in the depths of the wound. The reason given for suturing in this way was, that if one began at one end of the wound, there was a danger that the edges would not be drawn into correct apposition with each other, and the "wounde might be drawn awrye, and the member lose his beuty, and some tyme parte of his office" (Dale, pp. 2-3). In other words, to avoid deformity and loss of function.

The dressing used for these wounds was of a more elaborate character than that applied to the simpler ones. The basic dressing of tow and white of egg was fortified with other substances such as dragon's blood (the resin of *Calamus draco*, Castiglioni, "History of Medicine," p. 384). As in these cases it was hoped that Nature would carry out the cure, the injured part was placed at rest and left for several days without interference. At the end of

this time, if all went well, all that was necessary, on removing the dressing, was to wash the wound with claret and replace the dressing.

In larger and more serious wounds, especially those in which tissue had been lost, all hope of Nature completing the cure without active assistance was given up, and vigorous methods were necessary to heal the wounded part. Drugs which had the reputation of actively reforming the lost tissues called *sarcoptics*, such as mastic and aloes, were applied to the injury. When the space had been filled with granulation tissue, the surgeon changed over to drugs which caused the newly formed tissues to cicatrize.

If in addition to the loss of tissue the injury was also contused, or contained dead or damaged tissue, digestives had to be employed before anything else, to bring on suppuration as quickly as possible. These digestives were generally of a somewhat complicated and messy nature, and no doubt were very efficient in bringing about the formation of pus. Low (*"Chirurgie,"* pp. 299-30) recommends a preparation which consisted of mallows, violets, and *anthea* all soaked together in fresh broth; to this mixture was added barley flour, butter, basilicon and yolks of eggs. After the wound had been cleaned by these digestives, *sarcoptics* were brought into use to stimulate the formation of new tissue, and finally the cicatrizing drugs completed the cure.

Gunshot wounds were looked upon as forms of contused wounds, and were dealt with accordingly. Our British surgeons, to their credit, were *Paréists* to a man; even if they did not acknowledge the debt that they owed to him in this matter. Gale (p. 1), for example, says:

The usual gonnepowder is not venomous, nother the shotte of such hoteness as is able to warme the flesh, much less to make an ascar (eschar).

While Lowe (p. 301) remarks that "Some think that there is venemosity in powder and burning in the bullet, which is false. I have cured divers within these thirtie yeares of divers nations . . . in the which I have found no more difficultie than in other contused wounds."

And finally Woodall (p. 97): "The most notable differences I have ever observed between wounds made with gunshot and other contused wounds, is onely a furtive hemorrhage, and a dangerous disposition to a gangrene; which two accidents warily prevented, the cures of such wounds differ nothing from ordinary wounds contused."

The first stage in the treatment of gunshot wounds was to remove the bullet and any other foreign body that might have been pushed in with it. If it was not possible to extract the bullet without causing great damage to the soft parts, it was considered better to leave it in situ. After this had been done the treatment followed the lines used in contused wounds. Suppuration was brought on by digestives; this was followed by the application of *sarcoptics* or *incarnatives* to stimulate the formation of tissue to fill the space left by the bullet; the healing of the wound was completed by cicatrizing drugs which consolidated the newly formed tissue.

In the sixteenth century, on the battlefield, gunpowder was frequently set on fire by accident; and burns from this cause were very common. Cartridges had not come into use, and cannons and muskets had to be charged with gunpowder that was not protected in any way. For the artillery, the powder was stored in open barrels; these were often very carelessly handled

in the field, and frequently set on fire with grave risk of injury to the gun crews. The musketeers carried their powder and shot in bandoliers. This was a cross belt from which were suspended about a dozen powder flasks and a bullet bag, from which a primer hung. Each of the powder flasks contained the amount of powder required to charge the musket for one round of shot. The primer contained a finer powder for charging the priming pan, and contained enough powder for several discharges of the weapon. The musket was fired by applying a lighted match to the pan, this ignited the priming powder, which in turn exploded the propellant inside the musket, and so discharged the weapon. Match was made of rope that had been soaked in saltpetre and then dried. When action was imminent, the match was ignited, and continued to smoulder until it was all used up. It was customary to light both ends of the piece of match in actual use, in case one end went out during the engagement. Spare match was stuck into the hat, hung from the bandolier, or wrapt round the body until it was required. It will be seen that the musketeer, festooned about with powder flasks, and carrying lighted match, was very liable, unless he took very great care, to set his powder and himself on fire. And as the soldier of that time was no more careful than those of the present day, it is not surprising that gunpowder wounds were very common, and often of a serious nature.

The most important characteristic feature of these injuries was considered to be the formation of an eschar and the presence of pain. The first objective was to remove the eschar, which it was believed also got rid of the pain. For this purpose Woodall (p. 98) recommended a decoction either of quince seeds or of mallows, or a more elaborate one of marshmallows, violets and parsley seeds. For the same purpose Lowe recommends a mixture of yolk of egg beaten up with oil of roses, barley flour, and bolarmeny. This preparation was applied to the wound on lint or linen soaked in oil of roses and yolk of egg. When by means of one or other of these preparations the eschar had softened and fallen away from the wound, the treatment could be completed and the wound healed with any of the incarnative and cicatrizing compounds commonly used. Other preparations could be used. Lowe strongly recommends another dressing for this purpose, which was sheep dung, fried in lard until it had dissolved in the fat. Verjuice was then added and the solution was filtered through a cloth. The filtrate was applied to the injury (Lowe, pp. 305-6).

It would be possible to go on indefinitely describing the treatment of wounds of special areas, and under special conditions, but this would drag out this paper to an impossible length. I shall, therefore, content myself with a description of the operation of amputation, as described by Clowes (pp. 94-8); as this gives a bird's-eye view of the work of the sixteenth century military surgeon, and of the preparations that they used during the different stages of wound treatment.

Let us assume that the operation was to be an amputation of the lower extremity below the knee. The patient was made to sit astride a strong form. Behind him sat an assistant, whose duty it was to hold him firmly by the arms. The leg to be amputated was laid along the form, and a second assistant sat

in front of the patient astride the leg, and held it firmly and steadily above the level of the amputation ; at the same time he dragged the skin and muscles upwards as much as he could. It was essential that this assistant should have large hands and a strong grip, so that he could prevent excessive loss of blood from the divided vessels. A third assistant was required to hold the distal portion of the limb, and had to be a man of considerable experience. It was essential that he held the limb in the correct position. If he raised it too high while the operation was in progress, the movement of the saw might be checked, if, on the other hand, he let it sag, the bone might break and splinter before it was completely sawn through. These preparations having been completed, the surgeon, with a sharp knife, cut through the soft tissues right down to the bones, making certain that he had divided the periosteum and the structures lying between the tibia and the fibula. The surgeon now took a saw and divided the bones as high up the limb as possible, and it was then removed. The soft tissues could now be pulled down over the stump and secured there by means of sutures, as recommended by Paré ; Clowes, however, did not consider this to be necessary. He says " I must confesse I have cured many, and never so stitched them." Instead of doing this, at this stage of the operation he applied a restrictive—or as we should say a styptic—to the wound, and the following is the one recommended by him :

R	Boli armeniaci	3	ij
	Sanguinis draconis	ana 3	j
	Aloes		
	Olibani	3	jss
	Terrae sigillatæ	ana 3	j
	Mastichis		
	Lapidis hæmatitis	3	ss
	Calcis extestis ovarum	ana 3	j
	Mumiæ		
	Gypsi	3	vj
	Farinæ volatilis	3	iiij
	Misce		

The amount of this powder necessary to dress the wound was mixed with the belly hairs of a hare and white of egg, and made into a paste. The surgeon had handy a number of plugs of tow, moistened with vinegar and water ; and he now instructed the second assistant to loosen slightly his grip on the leg, so that the vessels might bleed a little. This was done so that the surgeon could locate their exact position, and find out precisely where he must place his pledgets of tow. Having put them in position, he now placed over them a pad of tow of approximately the same area as the wound. This dressing was also moistened with vinegar and water, and on the wound side it was covered with the restrictive. This pad was now covered with a larger pad of the same material which overlapped the lower end of the stump, and was retained in position by a narrow bandage called a choke cloth. The whole dressing was covered with a linen cloth, and this was fixed in position with a four-inch roller bandage. If any reactionary hæmorrhage occurred, it was controlled by applying pads of tow firmly held in position by means of roller bandages.

Clowes knew that blood-vessels could be ligatured, but was of the opinion that the method was quite satisfactory for the control of hæmorrhage. The patient was now put to bed with the stump resting on a pillow, and was kept as quiet as possible for three days. After this period had elapsed, the dressing was undone and the wound was dressed with a digestive. This is the one suggested by Clowes :

R	Terebinthinæ in aqua vitæ	℥ iiij
	Vitellorum ovorum numero	℥ ij
	Olei ros	℥ ss
	Mastichis	℥ ij
	Farinæ hordei	q.s.
	Croci	℥ j
	Misce	

This preparation caused suppuration, which removed the dead tissue and cleansed the wound. After this process was complete it was necessary to encourage the growth of new tissue, and this was done by the application of mundifying preparations or incarnatives. The composition recommended by Clowes was :

R	Terebinthinæ	ana ℥ vj
	Olei Rosati	
	Resinæ Pini	℥ iiij
	Gummi Elemni	℥ ss
	Ceræ citrinæ	℥ iiij
	Misce	

The use of this preparation was continued until the wound was completely filled with new tissue, and then the healing of the wound was completed by consolidating and cicatrizing it with a desiccative such as the following :

R	Antimonii	ana ℥ j
	Creusæ	
	Plumbi usti	ana ℥ ij
	Lithargyri	
	Terebinthinæ	
	Olei Rosati	℥ iiij
	Ceræ albæ	℥ iiij
	Misce	

When we consider this method of the after-treatment of amputation cases, from the standpoint of our modern knowledge, it will not surprise us to learn that the results were extremely unsatisfactory, and, that as much as possible, the operation was avoided. During a period of twenty years, when Woodall was a surgeon at Barts, he did not himself perform, or assist at, more than five or six amputations a year ; and the mortality was appalling, only about one in five of the patients recovering from this operation (Graham, p. 167).

However crude the treatment of amputation and other serious wounds by digestion, incarnation, and consolidation, may appear to us to be, it was the best then available ; and it remained unchanged throughout the seventeenth

century. In Wiseman's textbook of surgery published in 1676 exactly the same methods are recommended as were used by his predecessors in the sixteenth century.

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THE ROLE OF THE CONSULTING SERVICES IN WAR TIME

BY

Brigadier J. A. MACFARLANE, O.B.E.

Royal Canadian Army Medical Corps

SOME of us in the middle fifties have lived long enough to have at least a vague memory of the South African war, a more vivid memory of the 1914-18 struggle, and finally we have the experiences of this last unpleasantness fresh in our minds. It may be of some interest therefore to look back quickly at these three wars and see something of the development of consulting services.

The medical services in the South African war were sorely lacking in equipment, personnel, and the means to combat disease and to treat wounds. Sir George Makins (then Mr. Makins) made one tour of the hospitals and some areas of the front, publishing his observations on the pathology and treatment of wounds in a volume dedicated to the R.A.M.C. in 1901. I can find, however, no reference to officially designated consultants in any department at G.H.Q. That there was plenty of room for improvement is evidenced in a book by Burdett Coutts, a member of the House of Commons for Westminster. He also travelled to South Africa as a layman and in a series of letters to *The Times*, and repeated attacks on the Government on the floor of the House, he brought forcibly to public attention, the shortcomings of the Medical Services. Makins re-published his experiences of the South African War in 1913.

During the war of 1914-18 arrangements were made for Makins and Sir Anthony Bowlby to go to France in September 1914. Subsequently consulting physicians were appointed to H.Q. and armies in other theatres of the war. In 1916 an advisory board of consultants was appointed to advise the Director-General at the War Office. Sir B. Moynihan was chairman of this Board and among other new appointments was Sir Robert Jones to represent Orthopædics and Colonel Sir William Fletcher on Dysentery. Those with whom I have talked tell me, however, that there was frequently a considerable gulf present between the administrative officers in high places and the consultant services. The consultants for the most part lived at H.Q. or one of the general hospitals, did their stint of operating or advising in difficult clinical problems, but were not taken into the councils of the service in relation to matters of general policy or the placing of personnel.

In our own forces Colonels Primrose, Elder and Armstrong, Hutchinson, Stewart and Gunn (in surgery) and Finlay, Rudolph, Martine and McRae (in medicine) were appointed. That they were not involved in the affairs investigated by the various commissions of those years is evidence on the one hand of the fact that they carried out their duties well, but on the other hand

is certainly evidence that the consultants of those days were given very limited responsibilities.

I well remember when leaving for overseas in January 1940 a parting gift from the Hon. Dr. Herbert Bruce. It was a copy of his book entitled "Politics in the C.A.M.C." setting forth clearly his considered opinion of the state of affairs in the C.A.M.C. in 1916, the evidence of the commission of which he was Chairman, and the events leading up to the subsequent authorization of other commissions.

My first experience with the consultant services of the Army began in August 1941. At that time Lt.-Col. R. C. Montgomery, Lt.-Col. Russell and I were seconded to Canadian H.Q. in London.

We were given offices and secretarial assistance. Our terms of reference were somewhat vague. We arranged to visit Canadians in English civilian hospitals and when convenient and desirable we sought to have them moved to Canadian institutions. Very quickly we became immersed in a variety of duties. Not the least, and indeed one of the most pleasant, were the visits and professional ward rounds in the General Hospitals and C.C.S.s then stationed in England with the Canadian Forces. It was frequently possible to advise the D.M.S. on matters of personnel, the abilities and qualities of O.C.s of Divisions and of specialists, the need for change, the facilities for training of specialists, and any other matters which would increase the efficiency and morale of the unit.

One of the earliest privileges accorded us by the D.M.S. was the securing for us of invitations to the monthly conference of consultants under the able chairmanship of the D.G.A.M.S. at the W.O., Sir Alexander Hood. Here gathered each month throughout the war consultants in every branch of the British Army Medical Services in England. There were frequent visits from consultants of the armies in the field, and after the declaration of war by the United States, representatives from the medical services of their armies were in constant attendance. The various sub-committees of this larger group dealing with surgery, medicine, hygiene, anaesthesia, etc., and reporting to the larger meeting, were so constituted as to include the representatives from our Army and the chief consultants of the U.S.A.

The Director-General at all times was at pains to keep us completely in the picture of overall planning in so far as the bounds of security would allow. The minutes of these various meetings together with various other communications of professional interest from the different theatres of the war were circulated to the Canadian members regularly.

During the following year it became obvious that the C.C.S. as then established could not keep pace with mechanized warfare. Plans were put in hand for a new unit which we called in our initial files an M.S.U. At about this time the consulting surgeon to the British desert forces had put together an *ad hoc* small mobile unit which he called a Field Surgical Unit, and so was born in the British Army and the Canadian Army this new unit which did so much to improve the scope and quality of forward surgery. True, our initial planning was a bit more elaborate—we had the time to build special trucks and

certain items of special equipment. Because they did not always fit the British I. 1248 there were occasionally difficulties in replacement, but we still felt we produced a good and workable unit. New hospitals constantly arrived in England, necessitating shifting of professional personnel. Our first division left for Italy with two of our F.S.U.s. Two general hospitals left shortly afterwards, then later another division with its complement of medical units and two further general hospitals and a 200 bed station hospital. The experience of our own units in Italy, of the veteran desert armies and those of North Africa allowed us to plan for the invasion of France.

New hospitals arrived constantly in England. New Field Surgical units and transfusion units were formed until finally the armies began to move to the new theatre of war in June 1944.

What is the role of consultant services? Looking back, one cannot find much to criticize in the War Office set-up as it finally functioned under General Sir Alexander Hood. Responsible to him directly were a consulting surgeon, a consulting physician, a consultant in transfusion and Directors in hygiene and in pathology. Ranged beneath this group were advisers and consultants in the various specialities, consultants to areas such as the Middle East, South-East Asia, Burma, the Mediterranean and North-West Europe.

General policy as to methods of treatment were laid down—with knowledge of the latest advances in every field of medicine and surgery. Field trials were planned, such as the use of penicillin in the early closure of wounds. Cairns, Florey and his associates were able to give to the War Office the first results of a mass trial of the new drug. From such data and experience new policies in the treatment of wounds to be followed during the invasion of France were clearly outlined by the consultants at the W.O.

The newer drugs for malaria treatment were investigated by teams of experts and the Army advised as to methods of prevention and treatment. In the early stages of the war the policy regarding sulpha drugs was a matter of much discussion in the Canadian Army. The Americans adopted a wholesale issue to every soldier with instructions to take it orally immediately after wounding. The Canadians maintained that sulphonamides should only be given by the M.O. or his stretcher-bearer. Questions were asked in the House of Commons in Canada as to why we lagged behind the Americans. This is only one instance of the responsibilities of the consulting service. We continued our practice of withholding the sulpha drugs as a personal issue and finally the Americans admitted after their experience in North Africa that the dangers of personal issue outweighed the advantages.

It is noteworthy that both in England and in Canada there was a close liaison with civilian authorities through the medical research committees on every phase of treatment relating to war wounds and injuries. Consultants from the forces sat down with the leading authorities in civilian life and discussed new methods and knowledge emanating from any source available. It remained for the consulting services to pass new information quickly to those in immediate charge of treatment in the field when it seemed that new methods were proven.

Their duties were (1) to advise those in the administrative side as to broad lines of treatment policy ; (2) to keep continually abreast of new methods and to assess the possible value of such new methods ; (3) to maintain a constant flow of new information to the officers in the field ; (4) to maintain the level of morale of the field officers by holding meetings, by arranging for short courses of training, and where possible and desirable to move specialists from one post to another, always keeping in mind the available supply ; (5) to keep close contact with Canadian H.Q. in Ottawa and to arrange supply and demand in line with both civilian and military needs of the nation at home ; (6) to be available for professional consultations and advice in the field and in the home hospitals. Actual operating was a small part of the consulting surgeon's duties, although he saw a tremendous number of cases of every variety in his daily and weekly rounds ; (7) to undertake the organization of field research by special units.

What did all this effect ? Certainly the consultant services alone cannot take the credit for improved results, but I believe that due to the organization whereby they had the trust and confidence of the administration, and were allowed to carry out such duties as I have outlined, the results in the prevention of disease and the treatment of wounds and injuries were truly remarkable. The maintenance of a high standard of treatment undoubtedly had a tremendous influence on the morale of the fighting soldier. General Hood's broadcast on the eve of the invasion of North Africa, when he proclaimed that the sick and wounded in this war had as good, or better, treatment available as in any civilian organization, did a great deal to bolster the morale of the wives and mothers at home. The blood transfusion service of the British Army, organized under Lionel Whitby, was in itself a tremendous factor in the saving of life. Blood and blood substitutes were, as you know, more easily available to the wounded soldier whether in Europe, Africa or Asia than they are even now in many places in this country. The entire initial supply of penicillin developed during the war by civilians was made available for soldiers and a tremendous saving of life and limb resulted. Today it is rare to see a case of osteomyelitis in hospitals. A great number of compound fractures which in previous wars would have resulted in loss of life, loss of limb, or at best long-continued osteomyelitis, were operated on early and, with the aid of antibiotics and other modern means, treated without loss of function. Typhus, because of an early and vigorous attack by a special team in Naples, faded out in the civilian population within three months, whereas no cases were notified among military personnel at all. The survival rate in abdominal wounds in north-west Europe was 68 to 70 per cent. In the last war it varied, according to such reports as are available, from 30 to 39 per cent. In certain selected groups towards the end of the war survival rates of 80 per cent were noted. This is an amazing figure when one remembers that the units which carried out this forward surgery, by the fact that they were well forward, received tremendously ill patients which would without prompt evacuation and prompt transfusion certainly have died before they could receive surgery. In this way the results cannot be compared accurately with those of the previous war where many hours might

elapse between wounding and reaching a C.C.S.; 70 per cent to 80 per cent survival rates include terrific multiple injuries, thoraco-abdominal wounds, and frequently those complicated by multiple limb injuries.

The overall mortality in wounds in the 21st Army group reached a very low figure indeed. The wounded man had 98 chances out of 100 of surviving and being evacuated to England. The incidence of gas gangrene fell steadily from the days of the desert fighting until the end of the war in Europe. These and dozens of other instances might serve as evidence that the professional branch of the Army laboured to some effect in bringing the most modern treatment to the sick and injured soldiers.

There were difficulties, but none that were not capable of solution. Occasionally administrators thought that consultants were too lavish in their plans, and were impractical and inexperienced in the exigencies of military situations. Some were dubbed "prima donnas" and were in trouble with A.M.D.3—nothing but the latest in operating kit would suit them. The "top brass" occasionally made disparaging remarks on their "swanning" tours during battles. Top administrators were sometimes rather slow in taking their professional colleagues into their confidence when plans were being made for new military ventures. But these same administrators were not backward in later asking the professional side to assume their share of the responsibility when the going was tough. I must say, however, that no group could have enjoyed more freedom and initiative than our own consultants at London H.Q. Of the situation here in Canada I have said very little because I was never in close touch with N.D.H.Q.

I think then that in any war which may be envisaged in the future the professional side must be represented in the very early stages of planning. In our initial plans for an expeditionary force in 1939 I know of no arrangements for any consultant services—and indeed none were made until we had 100,000 or more men in England. Up until that time several hospitals and C.C.S.s were working in England as isolated units, with scarcely any interchange of ideas and no suggestion of an overall Canadian policy regarding treatment of wounds and disease. Contact with Canada by mail was slow and we were an isolated force, except for our contact with the War Office and the British Army through the administrative H.Q.

It is fortunate that we had those early years of delay and training. If our forces had been committed to battle in the summer of 1940 there might well have been a repetition of visiting commissions from Canada to enquire into the treatment of the Canadian soldier. It is a source of satisfaction that throughout five-and-a-half years, the Canadian Army Medical Corps abroad did enjoy such a reputation for treatment and service that there was never even the suggestion of investigation or parliamentary questioning. I believe that a properly organized consulting staff can take some credit for the trust and confidence displayed by the government and the people of Canada.

In planning for future wars, it will be all the more necessary to have the immediate advice and help of specialists in many fields. Undoubtedly military and civilian problems in future wars will be even more closely related than in

the situation during the bombing of Britain. Consultants, however, when seconded to armies, will be better qualified for their posts if they have had some knowledge of military organizations. The men in these posts in the last war who were given their rank without any previous knowledge of military affairs occasionally rushed headlong into trouble with hard-shelled regular soldiers.

Such men should be young enough to stand up to a fairly strenuous round of travel, long and irregular hours, and the occasional hardships of campaigns. They should, however, be old enough to have acquired judgment and experience in their specialty and the confidence and trust of their colleagues.

These are the important points in making such a selection. There may be something to say for senior consultants and advisers acting in a civilian capacity. Such was the case in the Royal Air Force, but, generally speaking, it is difficult to see how they can gain the full confidence of their colleagues in the administrative branch unless they are willing to don the same uniform and become an integral part of the machine. On the other hand, as civilians they can gain access to the ministerial levels, which is denied them in uniform.

In whatever form and in whatever circumstances Canada finds herself at war on a future occasion, I am convinced that the purely professional side of the medical services should in the early stages be represented by a full and competent board of consulting specialists.

SOME OBSERVATIONS ON, AND METHODS OF, DEALING WITH MEDICAL PROBLEMS WHEN A PRISONER OF WAR OF THE JAPANESE 1942-1945

BY

Major C. W. MAISEY, *O.B.E.**Royal Army Medical Corps*

THE experiences endured by all as Prisoners of War under the Japanese were oppressive and barbarous. Nowhere were there conditions suitable for medical research although medical personnel were well placed to view an experiment in dietetics and hardship.

The writer was fortunate to remain in Java where he was the Senior Medical Officer for the whole period of imprisonment and where it was found possible, by methods clandestine, to produce in 1943 a hospital service which could hardly have been bettered as regards results under normal conditions for treatment of the sick. The story as to how the Japanese were inveigled into allowing two fine buildings to be used as hospitals and how a life line supply of medicines, food, and other materials was maintained by a small body of civilians, must be taken for granted.

The lessons learned were simple ones. Discipline was the greatest factor in preserving life, in particular with regard to aspects of sanitation and preventive medicine. Co-operation, knowledge and understanding were of equal importance. It was due to these factors in communities where individuals were controlled more by their emotions than by reason that results were obtained.

The brevity of this article does not permit a detailed account of the difficulties encountered and the methods adopted to conquer them.

As the poor diet played such an obvious part in the sickness produced, the official Japanese ration is given in the following table :

	Official ration grammes	Average received grammes	Carbo- hyd- rates	Pro- teins	Fats	Calories	Vit. A I.U.	Thiamin mg.	Ribo- flavin mg.	Nico- tinic acid mg.	Ascorbic acid mg.
Rice ..	500	350	273	24.5	1.0			0.15	0.15	3.5	
Sugar ..	20	20	20							0.2	
Flour ..	50	50	36	4.0	0.5		20	0.05	0.03	1.5	
Meat ..	50	35		7.0	1.5		20	0.18	0.08		
Salt ..	5	5									
Oil ..	5	5			5.0						
Tea ..	4	4									
Vegetables	300	150	12	2.5			2,000	0.25	0.50	1.5	30
			341	38.0	8.0	1,628	2,040	0.55	0.76	6.7	30
Minimum intake standard*				50.0		4,000	1,000	1.00	1.50	10.0	10-15

* From various sources [1]. At intakes below these levels, frank deficiency signs and symptoms are likely to appear under normal conditions. 20 mg. of animal protein is also recommended as the minimum standard for normal conditions. The balance of the diet should be in the region of : protein 12 per cent, fat 35 per cent, carbohydrate 53 per cent.

However, a description of the medical work carried out in one of the main camps and the special P.O.W. hospital which was separated from the camps is given. Hygiene in all its aspects was practised and in the writer's opinion was one of the chief reasons for the comparatively low death-rate experienced.

In practice the food varied enormously, the quantity of meat supplied included bone and for periods of months was not issued at all. For the last six months in the hospital, which closed in April 1944, it consisted of intestines and lungs only. The rice was polished, and after the first year reasonable in quality, the first year it was so bad and in such a state of deterioration and filth that wastage varied from 30 per cent to 80 per cent before being cooked. From midway through 1943 until its closure, the issue of rice in the hospital dropped to 150 mg. per man per day. The flour ration was used to bake a loaf weighing 300 grammes and was issued daily to each man.

Vegetables consisted in the main of green leaf types, cucumbers, brinjals, sometimes carrots, sweet potatoes and, once, potatoes. The quality was seldom good, the delivery in the hospital execrable, invariably intestines and faecal contents had been shovelled on top of a load of what resembled the sweepings from a vegetable market. During the last six months of captivity tapioca root and maize was the staple diet. It was after a few weeks of this diet that classic cases of pellagra were seen.

Depending on the particular mood of the Japanese the ration could be supplemented with supplies from a contractor. During the times when it was possible to buy, every effort had to be made to purchase and store food. Although the storage of food was forbidden, a thirty-days' supply was built up and hidden in the hospital from December 1943 to February 1945. A day's supply for one man under those conditions meant 100 grammes of katchang hijau or brown beans. Katchang hijau bean (*Phaseolus radiatar*) is a small green legume rich in vitamins B₁ and B₂. After the arrival of Red Cross supplies it became easier to store food as permission was obtained to keep some of the contents for patients. Individuals accepted the cigarettes, sweets, coffee and sugar, but allowed the milk and meat contents of the parcels to be used to the best possible advantage. This policy must have been cruelly hard to bear, but the staff and patients accepted it and no one claimed his share though he was allowed to do so.

Brown beans and nuts were particularly valuable to buy, not only on account of their food value but because it was possible to store them for some months. Eggs were salted down. Fruit of all kinds was available. Oil made it possible to vary the monotony of the diet. Firewood though expensive was an essential. The stewing of the over-ripe fruit alone was a big factor in the control of dysentery.

The above commodities were seldom available in large supply and as the years passed became prohibitive in price. For example katchang hijau beans which were 14 guilders per bag of 100 kilos in 1942 rose to 800 guilders a bag in 1944. Eggs which were 2½ cents each rose to 2 guilders and 50 cents; the rise in price of other commodities was similar.

Officers were paid 20 guilders a month, men 10 cents for a day's work. In

most camps there were contributions of 10 guilders a month from the officers for the sick fund. The hospital suffered in this respect as there were few officers in comparison to the number of sick, and much of the money came from sales and black market deals. Due to this variance in the capacity to supplement the rations it was quite impossible to say how much food an individual did eat.

The above description of the food available demonstrates that primary deficiency diseases could be expected on account of the gross imbalance of protein, carbohydrate, and fat, and the low vitamin content.

The value of rest in diminishing or completely abolishing the appearance of avitaminotic signs was clearly demonstrated in patients who were receiving no extra food from the remainder of the camp. This group included patients suffering from pulmonary tuberculosis, bone tuberculosis, aseptic wounds, over 100 cases of venereal disease who were segregated, and non-septic skin infections. In addition the officers produced far fewer cases in proportion than the men. The men worked hard in the docks, the officers sat in the camp. A group of "finicky eaters" was also a factor with the officer group. It is obvious that a man who was not willing to eat rice which contained a large percentage of maggots, weevils and rat droppings was generally more cleanly in his habits and personal hygiene and, therefore, was not so liable to contract dysentery.

It appeared that the metabolism of the human body reacted better to the change from a normal balanced diet to one of almost complete starvation, from the point of producing avitaminotic complaints, than to one not so low in content when it consisted predominantly of carbohydrate.

On the other hand, groups of men who contracted "secondary causes" of malnutrition, developed signs of avitaminosis rapidly—intestinal complaints, particularly dysentery; septic complaints even quite small lesions such as infected cuts or infected scabies. Many could not masticate their food properly (it was surprising the number of men who had lost their dentures during the retreat). Many were unable to sleep, whatever the cause.

In view of what I saw my policy in administration of the hospital was to concentrate on the following essentials.

(1) (a) Education in hygienic principles for all ranks. If we could teach men how to conduct their daily toilet (even without toilet paper), and not contaminate their food.

(b) If we could teach men to wash their hands before meals.

(c) If we could teach men to wash their eating utensils before and after meals.

(d) If we could teach them that the destruction of the fly, the mosquito, the bed-bug, the louse, was worth all the trouble it entailed.

(e) If we could teach the officer that it was intelligent men who were required for hygiene and nursing duties.

If . . . the list seemed endless, but it had to be accomplished to keep down the death-rate.

(2) Balance the diet for the seriously ill, at least.

(3) Ensure peace, quiet, and contentment for the sick.

(4) Maintain the highest standard of treatment for all classes of sick. Concentrate on those who were most likely to die. The last principle may seem strange, but it was necessary under the conditions which prevailed. I considered that once the state of "condemning" patients to die because their condition seemed hopeless crept in, it would mean inevitably that more and more patients would be placed in that category. This attitude of mind was common and, in one camp when I was trying to launch a scheme for the collecting of funds for the benefit of the sick, the opinion was expressed that it was far better to give extra funds to the fit men.

There were 3,500 men and 400 officers in Tanjong Priok camp when it was first occupied in April 1942; by February 1943 approximately 16,000 had passed through it.

It was a bad camp from the hygienic point of view. It had been a condemned coolie lines built on reclaimed land. Such sanitary conveniences and water supplies that existed had deteriorated and were a fruitful source of flies and mosquitoes. For the first three months of residence in this camp it was not possible, owing to Japanese orders, to arrange refuse disposal outside the limits of the camp or to incinerate it in the camp. The camp was in an area approximately 600 yards by 800 yards and inside the wired perimeter were thirteen sub-camps each wired off from its neighbour. The shallow trench latrines in the subcamps were nightmares and beggar description. Situated a few yards away from where the men ate, lived and slept, it is little wonder that there was a devastating epidemic of dysentery and diarrhoea.

Tanjong Priok is the dock area for Batavia and has always been feared on account of the high incidence of malaria in its environs. The Dutch doctors told me that the splenic index of the local village was 76 per cent. Captain Cook mentions it in his account of his voyage, 1772-1775, which earned him the Copley Medal.

Malaria cases were constant at about 280 fresh cases per month until August when they fell to 80, and during the wet season of December and January about 20 fresh cases each month. Dengue was a prevalent disease in June when there were over 2,000 cases, some of these cases were probably cases of malaria, but with no microscope it was not possible to differentiate in all cases.

The average number of dysentery or diarrhoea cases for May, June and July under daily supervision (treatment is hardly the correct word), was 726, 876, and 1,316; as conditions improved in every respect the numbers fell until by December there were about 20 fresh cases per month.

Phagedenic ulcers were common from June until October, in all 2,700 men were infected.

Diphtheria made its appearance at the same time and not only did it complicate the cause and prognosis of the ulcers, but of the malnutrition cases as well.

Before describing some of the more interesting complaints seen, a brief review of the measures taken to combat the general conditions will be given.

We were fortunate in the fact that there was a quantity of building material

close at hand which had been intended for the construction of a new coolie line, and that there were two engineer officers in the camp with wide experience of the East.

Water supplies were run into each sub-camp.

The water-borne latrine system was repaired. In seven of the sub-camps there was a septic tank which had to be emptied by hand, this involved officers and men standing waist deep in sludge. In the other camps, bucket latrines with a cement base and a drainage system were constructed. Emptying in the sea on a falling tide was the method of disposal. An incinerator was constructed and thereafter all waste material was burnt.

Two Serbian Barrel disinfestors and a laundry for the hospital were constructed.

The central kitchen received close attention. As far as possible fly proofing of all food supplies was instituted. A machine was constructed for separating the rice from maggots, weevils, rat droppings, dust and stones. In addition ample washing accommodation was laid on for the cookhouse personnel.

A central open-air wash-house was repaired and a grease trap fitted. It was hoped that the grease would be caught and by obtaining caustic potash from the wood-ash it would be possible to make soap; unfortunately the Japanese would not allow this.

The complete reconstruction of the hospital was carried out so that there was light, ventilation and isolation. Doors were taken off buildings to serve as bed boards and also to ensure some measure of ventilation in the grossly overcrowded quarters. At a later period all of the buildings were opened out so that there was as much light and ventilation as could be managed. This measure was important also from the point of view of driving the mosquitoes out of the dark rooms in the daytime. The scale of accommodation was ten men to a coolie tenement. This consisted of an inner room with no windows, 8 feet by 7 feet, and an outer verandah type room of similar dimensions.

As mentioned above the camp site and its immediate environs was reclaimed land through which ran a complicated system of shallow concrete drains. Efficient drainage of this area was not possible by ordinary means and yet it was of the utmost importance that some measure should be taken. Mosquito larvæ were breeding prolifically in and around the drains, the earth had sunk but not the drains, and it demonstrated what is not uncommon, that lack of maintenance of hygienic measures brings as much or more trouble than previously existed. A few of the drains were regraded, but the flat nature of the terrain militated against efficiency. The denial of antimalarial or paris green to destroy the larvæ forced the following method into use.

Marshy areas extending to a distance of 300 yards from the camp (where it was not possible to fill with earth) were drained by shallow herring-bone method. Some 270 areas of 300 square yards each were treated in this manner. It had the effect of making it easier to spot the breeding places of the *Anopheles sundaicus* which was the most likely vector in that brackish water. The prepared sites were swept dry every third day, and the drains every day.

All tins and receptacles such as coconut husks were collected, this last measure brought to an end the dengue epidemic.

Difficult though it was to carry out the above work, the urgency of the problems gave great determination and drive to the individuals who tackled it with few and inferior tools.

More difficult was the task of inculcating a hygienic method of living to the individual. Lectures and talks were of little avail, an attempt was made to conduct a series of lectures in hygiene. There was only one Regular Army unit in the camp, from which the Commanding Officer and two senior N.C.O.s attended the course, with the exception of one other officer and N.C.O. the remainder were private soldiers of dull mentality. This attitude towards hygiene and sanitation was somewhat unexpected in that environment. During that time it was noticeable that the care of the sick was the job of the medical officers only, appeals for help had produced poor response. It is a sad fact to record that until a number of deaths had occurred many were not shaken out of their lethargy and apathy, although it was obvious that six medical officers and eight trained nursing orderlies could not cope with the situation.

The following plan was instituted, all sub-camps were to make room available for their own hospital and only seriously ill patients would be admitted to hospital. The Japanese took a good deal of persuasion regarding this matter but it was accomplished. It served a number of excellent purposes.

(a) It brought home to many officers their responsibility towards the sick in a practical way.

(b) It served to train more orderlies.

(c) It was a very good method of spreading medical propaganda.

(d) It produced a rivalry between each sub-camp to try and produce the best hospital. From that arose better hygienic conditions in the sub-camps.

(e) It gave the hospital staff some chance to arrange the hospital and stop the cross infection which thrived in it.

An officer was in charge of these sub-camp hospitals and accompanied the doctor on his round. They were all very keen and were only too pleased to get down to a job of work, particularly for the benefit of their own men. There were numberless good features about this method but probably the most striking was the co-operation it engendered between doctor and combatant officer.

Morning and evening rounds were carried out, the latter of great importance because seriously ill men were transferred to the camp hospital as all sub-camps were locked at 7 p.m.

By September of that year the average sick rate had dropped from a peak figure in July of over 3,000 per day to under 700 per day.

The invaluable supply of drugs from the civilians started in June and undoubtedly played a great part in not only reducing the death-rate, but in lifting morale to a high level.

As the fly menace diminished so did the incidence of dysentery. There was one sharp outbreak of dysentery in December when there were few cases in the camp. Twenty men ate some cooked katchang hijau which they found

and reheated, and within a few hours developed acute dysentery of a most severe type. The danger of eating recooked food was well demonstrated.

Space does not permit of detailed descriptions and methods of treatment of all the diseases seen ; of interest were the cases of phagedenic ulcers and the " burning feet " syndrome.

There were numerous types of ulceration, but in the group to be described there were approximately 500 cases. These ulcers were seen in the period May to September of 1942, and made their appearance a few weeks before the onset of the diphtheria epidemic.

They were essentially multiple, a small blister, like a cigarette burn, was the first sign, this burst within forty-eight hours leaving an ulcer with a clean punched-out appearance. A delicate membrane covered the base of the ulcer, serum oozed ceaselessly. If there was further secondary infection a slough formed and the ulcer might become serpiginous in outline. The membrane we thought was a diphtheritic manifestation and it soon turned black on exposure to the sun. The most common sites were the dorsum of the foot and the leg up to the middle of the thigh. Trauma seemed to play a role in the production of these ulcers, a strap fixed on the wooden clogs was probably the predominant cause of those on the dorsum of the foot. Insect bites on the legs could not be proved to be a contributory factor, though it was strongly suspected. Clements in Melanesia and James in the Solomon Islands hold the opinion that B₂ deficiencies in the diet predispose to this type of ulceration. Manson-Barr describes a similar type of ulceration in over-driven and half-starved labour gangs in Melanesia. Prowazek attributes this type of ulcer to an infection caused by *Spirochaeta schaudinni*. Certainly the epidemic diminished in intensity before better feeding became available and waxed and waned in close accord with the number of diphtheria cases [2].

It was of interest to read the article written by A. D. Leigh in the *Lancet*. February 21, 1948, in which he describes diphtheritic polyneuritis associated with similar ulceration which occurred amongst British Troops serving in Assam in 1942. He isolated *C. diphtheriae* from 9 out of 23 ulcers. He also describes nasal regurgitation in a number who suffered from " jungle sores " but gave no history of sore throat.

In one sub-camp of 350 men, during a routine medical examination, 40 cases of paresis of the palate were discovered. Not one of these men had reported sick with a sore throat, but they all had ulcers on the legs. A relationship between ulceration of the legs which had been secondarily infected with *C. diphtheriae* and palatal paresis was established.

C. diphtheriae would appear to have a predilection for infecting skin lesions caused by avitaminosis ; scrotal dermatitis, cheilosis and stomatitis were readily infected. A membrane appearance on the scrotum, and in and around the mouth, the lesions have the appearance of being painted with congealed white of egg.

The most puzzling aspect of these ulcers was that they occurred only during that period, the diet did not improve for some months after they had disappeared ; in later years the diet became as bad, but there was no reappearance

of this particular type of ulceration. The nearest approach was in the last few weeks, when following a diet of tapioca and maize a number of cases of large blisters in the same situation on the limbs occurred, but these cases rapidly developed the closest resemblance to textbook pellagra which we saw throughout the period of internment.

My suggestion is that the cause might be dietetic in nature, though this is contrary to accepted opinion. There was a marked shortage of the B₂ vitamins, but the efforts of the body to synthesize essential amino acids that were missing may have played a part. There were other conditions which demonstrated this "time" factor such as a spastic paralysis of the legs.

I do not consider that these ulcers were caused by *C. diphtheriae* infection. Treatment with sulphanilamide powder, diphtheria antitoxin, formalin (40 per cent), iodoform powder, mapharside injections, in various cases produced a clean ulcer but they all took a minimum of eight weeks to granulate and heal. Ulcers which had not become secondarily infected, and had not been bandaged (this was found to be bad treatment), but had been kept dry with controlled sunbathing healed in the same time.

One of the most interesting complaints seen was the "burning feet"¹ syndrome. The first cases occurred within three months of becoming a P.o.W. The first thing noticed by the man was a burning sensation of the soles of the feet and if he had a blanket he had to keep his feet uncovered at night in order to get off to sleep. Later there were severe spasms of burning, boring, stabbing and shooting pains in the feet and lower parts of the legs, sometimes the hands were affected similarly. The sufferers could scarcely make the first movement of walking so severe was the pain, but once started the pain diminished in most cases. In a number of cases the patient complained of burning sensations in other parts of the body. Even when the pain had ceased there was a most uneasy feeling in the limbs. As a sufferer of this complaint I can best describe this feeling in the legs as being similar to the sensation in the limbs after running a strenuous quarter-mile race. At this stage of the disease it was noticed that the palms of the hands, particularly over the hypothenar eminence, and the soles of the feet had a peculiar heliotrope colour. This colour was not always present and sometimes when the burning pain disappeared the colour disappeared. In all cases there was an extreme hypersensitivity to light touch; walking on grass or sand was acutely painful. The feet sweated profusely and felt cold on handling them. The joints of the hands, wrists, ankles and knees, but mainly of the toes and fingers, were stiff and painful, particularly in the morning. Swelling of the hands was also noticed. In severe prolonged cases there was atrophy of the nails. Hundreds of men after a hard day's work would tramp about at night, at intervals bathing their feet in cold water which gave some temporary relief.

It was the loss of sleep occasioned by this disability which rapidly reduced the physical condition of the sufferers.

Before the burning feet was first noticed in the camp a considerable number

¹ Described as "Happy feet" in previous articles written by Medical Ps.o.W. in Malaya.
[Ed.]

of Ps.o.W. had demonstrated the symptoms of hyporiboflavinosis: angular stomatitis, cheilosis, glossitis and scrotal dermatitis. By August of 1942, 70 per cent of the members of the camp had suffered from one or all of these complaints but not all developed burning feet, and a few developed burning who had suffered none of the other complaints.

The "camp blindness" which made its appearance in October seemed to be connected with the same deficiency as "burning feet," in over 300 cases of "Retrobulbar Optic Neuritis" 84 per cent suffered from burning feet.

The following table gives a summary of the signs and symptoms of the "burning feet" and peripheral neuritis:

	<i>Peripheral neuritis</i>	<i>"Burning feet"</i>
Mainly associated with	Thiamin deficiency	Riboflavin deficiency
<i>Subjective Complaints</i>		
Early sensations	Weakness in legs	Jumpy irritating sensation in legs
Radiating pains in extremities	Absent or slight	Predominant and severe
Painful joints	Absent	Present
Disturbances of vision and hearing	Absent	Present
Parasthesias	Numbness, muscular cramp and twitchings	Severe burning sensations in all parts of body, particularly the feet. Alternated by cold and numb feeling
<i>Objective Signs</i>		
Looked ill generally and underweight	Yes	Not always \pm 50 per cent cases
Œdema	Yes \pm 50 per cent cases	No. When œdema appeared the burning feet disappeared
Superficial touch	Impaired	Marked painful sensation
Deep pressure	Tender	Not tender
Tendon reflexes	Hyperactive—then decreased—absent	Normal
Abdominal reflexes	Present	Present
Extensor response	Absent	Absent
Paresis-paralysis	Flacid type causing foot and wrist drop	No paresis
Skin temperature	Normal	Cold but sweating
Skin changes	Nil	Cyanotic, heliotrope colour of soles of feet, toes, and volar aspect of hands
Associated with blurring vision, or deafness or nystagmus	Not until last two years of captivity. When on recovery 90 per cent complained of burning feet	Yes, appeared to be associated in all cases of "camp blindness," deafness or nystagmus

In December an attempt was made to carry out a small experiment in treatment of the eye cases. A canteen had come into being in October and by

December it was possible to place orders for a relatively large amount of foodstuffs. Katchang hijau beans owing to a high content of B₁ and B₂ was an obvious choice, and also brown beans which had a high protein content. In addition the Japanese allowed a small issue of offal.

90 of the worst eye cases were taken, their vision was all worse than 6/30 and they all had burning feet, the experiment was directed against the eye symptoms and lasted three weeks.

Group	Cases	Received	Result	
			Eyes	Feet
1	10	Thiamin 10 grains t.d.s.	Nil	Nil
2	5	Nicotinic acid 150 mg. per day	Nil	Nil/Good
3	10	Red palm oil 3 tablespoons per day . . .	Nil	Nil
4	5	Riboflavin 10 mg. daily	Nil	Good
5	5	Thiamin 5 grains t.d.s. nicotinic acid 150 mg. per day	Nil	Good
6	5	Thiamin 15 grammes Nicotinic acid 50 mg./day. Riboflavin 5 mg. Cod-liver oil tablespoon per day	Nil	Good
7	20	Fresh liver 100 grammes daily	Slight	Fairly good
8	20	Katchang hijau beans 200 grammes per day . .	Nil	Fairly good
9	10	Two duck eggs daily	Nil	Nil

This camp closed down before the experiment ended and all of these eye patients were sent to a new P.O.W. hospital just opened. Three months later I went to take command of that unit and all of the eye patients in Groups 2, 4, 5, 6 and 7, with only three exceptions, had markedly improved vision. Group 6 showed the best improvement, four of those cases had been "blind" and could only distinguish between light and dark, now they had reasonable vision, and could distinguish friend from foe. Group 7 also showed excellent results. Whilst in hospital they had received 200 grammes of fresh liver per week and 150 grammes of katchang hijau daily.

At the same time there were nearly 200 other eye patients who had entered the hospital, but who had not had the opportunity of receiving intensive treatment. They nearly all recovered but took a further six to nine months to do so.

During the experiment several interesting points were noticed. Those groups receiving riboflavin, and particularly in conjunction with other vitamins, showed an exceedingly rapid amelioration of symptoms of glossitis, cheilosis, scrotal dermatitis and such an improvement in the burning feet that they all slept well. There was no improvement of any of these conditions with thiamin or of red palm oil alone. Two of the cases treated with nicotinic acid stated that there was remarkable improvement of the burning feet.

Conclusions made at that stage were that lack of riboflavin appeared to be the main source of trouble; and there would appear to be a balance necessary between all the vitamins before a successful result in treatment was achieved. Injection of vitamins was the most efficient method.

There was undoubtedly a shortage of protein in the diet and a marked depletion of essential amino acids. However, it was seen that the burning feet and other symptoms could be ameliorated and in some cases cured without

the addition of animal protein to the diet. The general low protein intake as such could not be held responsible for the outbreak of the deficiency syndromes, although it probably had an aggravating effect. It can be expected that there are many interrelationships and points of contact with amino acids and vitamins but more research is needed to elucidate these connexions.

It was thought that the marked reduction in the fat content of the diet which was non-existent for a period of eight months and then was issued in amounts of $\frac{1}{2}$ to 2 oz. margarine per man per week, would have produced some obvious changes. However, the shortage probably played its part in increasing the amount of thiamin necessary for the oxidation of carbohydrate, which the men consumed in large quantities when the opportunity occurred. As mentioned before it was the gluttons who succumbed first to diseases considered to be due to avitaminosis. Classic cases of wet beri-beri were seen in that type of individual.

Reference must be made to two other difficulties which caused those in medical charge much concern and had a big effect on morale.

The first was the cases of sudden death which occurred. There were three of these, and in each case the man had appeared to be a normal healthy individual—had gone on working parties, taken part in recreation, in one case had been a keen gardener and had been digging over his garden just prior to dropping dead. Post-mortems were never allowed. It is suggested that *shoshin* or acute heart beri-beri was a likely cause or it may have been due to myocardial failure due to diphtheria. I encountered three further cases in later years and medical officers who returned from labour camps outside Java reported similar cases. The importance to the medical authorities was the extra work involved in trying to examine each man at regular intervals. The most that could be done in the camp was to keep a careful check on those who took part in organized games, or had to carry out consistent heavy work such as a blacksmith or baker.

The second difficulty was major surgical emergencies, the question of an efficient anæsthetic had to be solved (the Japanese had carried out two appendicectomies without using an anæsthetic; both patients had made a good recovery). It was becoming more and more difficult to obtain local anæsthetic from the civilians, and with the influx of the elderly Dutch soldiers it appeared that we would be faced with more major surgical cases.

Tanjong Prick camp closed down in February 1943, most of the members of the camp went to labour camps overseas, in a number of cases without any medical personnel at all, and the order which made the sub-camp Commanders and officers play a practical part in looking after their men was even more appreciated.

In June 1943, I went with three other medical officers to St. Vincentius Hospital; until December I was the adviser to the commanding officer of that hospital and of the infectious wing of the Mater Dolorosa Hospital. In January 1944 I was made commander of both hospitals, though visits to Mater Dolorosa were infrequent.

These hospitals had difficulties which we had not appreciated when we had been working in the camps.

Obtaining funds or extra food was a most difficult and complicated task, as the small staff were the only ones earning money and the Japanese could apply to the full "sick men half rations." It was always a complaint of new arrivals that they had not half as much to eat in hospital as in the working camps.

In the course of time a laboratory, dispensary, operating theatre, dental centre, physiotherapy department, E.N.T. department, dark room, and X-ray department were established. Much of the equipment, although crude, was ingenious; some of it such as the dental surgery equipment which was the personal possession of a Dutch officer was excellent.

All wards were bare of any equipment when the hospital was taken over. Bamboo beds, mattresses, pillows, bamboo urine bottles, bed-pans, commodes, bed-rests, cardiac tables and screens were made. The last named was important. Privacy was sought after by all Ps.o.W. and it is essential for a patient gravely ill.

The Japanese name for the hospital meant "The House for Dying Men," and with the exception of the patients who were sent to it when it first opened, it is a fair description of 70 per cent of the patients admitted. It appeared obvious that unless something could be done to keep the Japanese out of the wards the reign of terror, which had existed since the opening of the hospital, would continue, and would nullify any chance of treatment of the sick. In camp it had been seen that arrogance, foolishness and often downright pig-headedness of individuals had heaped collective punishment on the whole camp, often with dire results to sick men. It is not the purpose of this dissertation to explain how the Japanese were handled in this respect but change they did and finally the patients were left in peace and quiet. The last eight or nine months the Japanese staff, "*mirabile dictu*," actually displayed an interest in seeing men get better.

The first arrival of large numbers of patients from the labour camps had been attended with nothing but chaos and confusion. These men had suffered similar experiences to those who were slave gangs on the notorious Siam railway construction scheme. When they were too weak and frail to work, even by Japanese standards, they were transferred back to Java. After a voyage lasting from four to eight weeks, made under appalling conditions, the survivors, varying in number from 100 to 350 at a time, arrived at the hospital from December 1943 until the Japanese capitulation.

Rice, stew, and half a pint of water once a day were the rations on the voyage, the overcrowding until the dead were thrown overboard was so great that the men sat with their knees up to their chin and were unable to stand up or stretch.

The majority were too weak when they embarked to climb the ladder in the hold to get to the latrine, dysentery was rife on all ships and many had taken off their fouled garments and arrived naked. The stench in the railway carriages was so great that the Japanese refused to enter them to search for

men who had died on the train journey from Sourabaya to Batavia. The majority of the men who were admitted to the hospital were paralysed, some with ascites and hydrothorax and fantastically cedematous from the unnatural immobility they had endured; numbers of them were "fixed" in the sitting position. There was gross cedema of the feet, legs, buttocks, scrotum and penis and of the elbows. In many cases as much as 25 to 28 kilos (55 to 61 lb.) of cedema was lost by these patients during treatment. Numbers of dehydrated patients weighed as little as 21 kilos (3 st. 6 lb.), normal weight 10½ to 11 st. 30 per cent of them were blind, 10 per cent were deaf, and many had lost their memory, all were confused and highly emotional. For all of the drafts of this nature 90 per cent suffered from dysentery or diarrhoea, and with the exception of the first draft were heavily infected with malaria. Infected scabies and infestation with pediculosis was universal and the majority were lousy. A few had paralysis of the diaphragm and a like number had paralysis of the left recurrent laryngeal nerve. Blood pressures were low, systolic 80 mm. Hg/diastolic 40 mm. Hg but in some cases down to zero.

A description of two patients from case notes which were brought back to England will serve to complete a description of these patients and demonstrate what we were able to do for them.

Private, aged 23.

On arrival, semiconscious with contraction of flexor muscle groups, paralysed legs and arms. Paralysis of the recurrent laryngeal nerve with hoarseness, paralysis of the phrenic nerve with an immobile diaphragm, and involvement of the vagus causing heart block. Breath sounds audible over upper two intercostals on both sides only, optic neuritis, vision 6/60. Complete loss of memory for recent events, and confused memory for past events, he remembered his name but not his age or unit or other personal items. He had bacillary dysentery and was incontinent. He had retention of urine and oliguria. Blood slide positive for B.T. malaria. He had infected scabies and was heavily infected with pediculosis, nits on all hairy parts of the body. Dysentery was treated with sulphaguanidine, 10 tablets per day, and responded rapidly. A rigor on the night of admission was treated with quinine. He received 30 mg. thiamin daily, intravenously for ten days followed by 20 mg. intramuscularly for three months later reduced to 10 mg. daily. 250 mg. of nicotinic acid daily by mouth. A pint of fresh milk daily for twenty-eight days then reduced to one-third of a pint. A special diet was cooked for him for several months. For the first fortnight he had to have someone with him constantly in order to compress his thorax and help him breathe and cough up his sputum. The twelfth day after admission his diaphragm began to get stronger and breath sounds could be heard down to the fourth intercostal space. He developed a pneumonia with high fever, cyanosis and a sputum containing encapsulated pneumococci, with a respiration rate of 40 per minute. This responded to sulphapyridine. Weight extension and massage was used for extension of his contracted limbs. By use of the X-ray his cardiac condition was carefully assessed before and during physiotherapy treatment. A year later he was walking about and looking reasonably healthy, though his memory was still a blank for the journey from Ambor to Java.

The other case was of a man who weighed 30 kilos (4 st. 10 lb.), his normal weight was 11 st. 12 lb. He was able to sit up and talk. He had suffered from malaria and dysentery for two and a half years and had had an attack of diphtheria. He was markedly anæmic, his tongue, lips and mucous membranes were white, and blood examination showed R.B.C. 500,000 per c.c. Hæmoglobin between 10 and 14 per cent. Blood slide positive B.T. malaria. He was given twice weekly a blood transfusion from donors on the staff.

Two-thirds of a pint each time. It was only after the seventh transfusion that any benefit was seen and a further three transfusions were given. He received frequent small meals of meat, such as heart muscle, and fresh liver, stolen from the Japanese, and tinned meat from the Red Cross supplies. A pint and a half of milk daily, fruit and eggs when available. Medicinally he received injections of liver extract, 1 c.c. daily for a month. Thiamin, nicotinic acid and cod-liver oil. One year later he was walking around, weight 50 kilos (7 st. 12 lb.), R.B.C. 3,700,000 H.C. 70 per cent.

The death-rate on the journey to Java was 44 per cent for all of the drafts and in one ship it was 386 out of 574. Altogether there were just under 2,000 patients of the above type admitted of whom 24 died and 19 of those died in the first forty-eight hours after arrival.

St. Vincentius Hospital under Japanese conditions accommodated 700 patients but a peak load, when two of these drafts came in within two days of each other, reached 1,117. The staff was approximately 100, made up of 12 doctors, 8 other officers, 28 nursing orderlies and the remainder working party men of whom 7 worked in the Japanese quarters.

The above description demonstrates why it was imperative to keep away the chaos and confusion of the Japanese. The first arrival had been disastrous, nothing prepared and the Japanese searching the miserable belongings of these unfortunate individuals so that it was hours later before we could do anything for them.

After an argument with the Japanese which lasted for over a fortnight we were given permission to supervise the unloading and disposal of the patients ourselves. It became a highly organized procedure in which every member played an important part. It would be boring to read an account in detail, the main essentials were speed in unloading the lorries, this reduced friction with the Japanese guards, a cup of tea and a cigarette before entering the building, all personal particulars from the patients, rapid sorting into medical categories, bath or blanket bath, and if possible complete shave from head to foot to get rid of lice, clean garments, blood examinations for malaria, faeces examination for dysentery, 10 mg. injection of vit. B, intravenous therapy commenced at once if necessary. For those who could eat there was a small meal of tea and two meat sandwiches. All of their kit was checked and labelled to correspond to a number printed in indelible pencil on the patient's hand. It was delivered back to them after it had been cleaned and passed through the disinfectant. Although meticulous in its detail and it involved much training and hard work it had its compensation. The remark of one patient from the Royal Navy on entering the ward for the first time, only to see one of his mates who had travelled with him already receiving a transfusion were, "Christ, you bloody well can't die here if you want to; law and order at last!" On another occasion a patient had a gangrenous appendix removed within an hour of entering the building.

The men from all of these drafts were highly emotional and once they realized that they were in safe hands the majority burst into tears. This emotional shock lasted for three or four days. The methods adopted to coax them back to normal, and make them more tractable to treat were :

(a) An increased standard of observable discipline amongst the staff, every member dressed in his best clothes, shaved every day.

(b) All of the wards in which these men were quartered were out of bounds to the rest of the hospital.

(c) A quiet order throughout the building was brought into operation, most of the Ps.o.W. wore "klompers" or wooden clogs and these made an irritating clatter on the tiled verandah, bare feet or soft shoes only were allowed. (Normally no shoes were allowed in the wards, which were highly polished tiles.) The polish used was coconut fibre (coconut flesh after the oil had been extracted), and was supplied as part of the ingredient for making bread.

The staff had learnt the hard way, that to allow these men to consume a normal-sized meal induced the most violent attack of diarrhoea. After the first draft the following scheme was introduced. With the exception of the extremely ill patients already in the hospital, all extra food and Red Cross supplies were used solely for this particular draft.

7.30 a.m. Breakfast— $\frac{1}{2}$ boiled egg, two slices bread and margarine, jam (home-made), tea.

10.00 a.m. Cup of soup or thin slice of tinned meat, slice of toast.

12.30 p.m. Pureed vegetables, about three tablespoonfuls, 75 to 100 grammes rice, two tablespoonfuls of grated coconut, fruit.

3.30 p.m. $\frac{1}{2}$ egg beaten up in milk— $\frac{1}{2}$ pint.

4.30 p.m. Tea, biscuit or thin toast, jam.

6.30 p.m. Mashed beans or katchang hijau, meat, liver gravy, fruit, tea.

This diet was generally necessary for about a week and then the meals were reduced in number and increased in quantity.

Other foods that were used in the make-up of this diet were peanut butter, fermented soya beans and tomatoes.

The bread made in the hospital deserves special mention. The Japanese formula for making the bread was :

Flour	..	..	150 grammes
Coconut fibre	..	..	30 grammes
Yeast, salt and sugar			

The flour consisted of tapioca, rice, maize, or katchang hijau in variable quantities.

Using the Japanese formula a product resembling rubber was produced. When eaten, even after toasting, it caused acute indigestion. After much experimentation it was found that when less than 10 grms. of coconut fibre was used, and our own yeast made from a maize culture plus sugar was added, a loaf light and airy yet firm in texture was produced.

Coconut was a most valuable food, apart from its high calorie content owing to the amount of fat it contained, it was found to be very good in relieving œdema. Frequently within forty-eight hours of stopping giving a tablespoonful of shredded coconut twice daily to a patient, œdema would return.

The hygienic measures and administrative details of the cookhouse and its personnel received much attention. It was divided into three parts each supervised by an officer. The special diets and general kitchen were controlled by a surgeon, the canteen kitchen by a scientist and the canteen by a dispenser.

These officers are mentioned because their previous training had a great effect on the excellent work they did. The surgeon was also one of a committee of three who classified each patient every third day as regards his diet. This work was most necessary and patients quickly realized that they were being treated fairly.

The surgeon instituted a standard of cleanliness in the kitchen that was very high. All handlers of food were subject to regular examination for dysentery, it was noticed that such cases of dysentery that occurred came from those who handled the incoming rations. The reasons were obvious in a country where human fæces was used as manure. The optimum cooking time for each vegetable was found, and on the occasions when there was a mixture of vegetables they were cooked separately, so that there was the least destruction of available nutrient. If the rations as supplied were considered likely to cause diarrhoea, they were destroyed, it was considered better to issue a small meal from hidden stocks than a large one which caused illness although it may have been more satisfying at the time.

Particular attention was paid to fruit, tomatoes or anything else eaten raw. If they were the least bit overripe they were made into "jam."

Eggs when obtainable were all washed before being sold, apart from the more attractive appearance, it probably played a part in cutting down intestinal infection.

During the fourteen months that the writer was in command of these hospitals there were the following deaths :

<i>St. Vincentius Hospital</i>										3,888 patients	60 deaths
Beri-beri	..	..	..	..	..	..	..	..	..	8	
Tuberculosis	..	..	..	..	..	..	..	..	..	3	
Peritonitis	..	..	..	..	..	..	..	..	..	6	
Carcinoma	..	..	..	..	..	..	..	..	..	10	
Late syphilis ?	..	..	..	..	..	..	..	..	..	9	
Cirrhosis of liver	..	..	..	..	..	..	..	..	..	5	
Pneumonia	..	..	..	..	..	..	..	..	..	4	
Diabetes mellitus	..	..	..	..	..	..	..	..	..	2	
Chronic heart disease	..	..	..	..	..	..	..	..	..	6	
Gastric ulcer	..	..	..	..	..	..	..	..	..	5	
Sprue	..	..	..	..	..	..	..	..	..	2	
										Total	60
<i>Mater Dolorosa Hospital</i>										1,566 patients	73 deaths
Bacillary dysentery	..	..	..	..	..	..	..	..	..	20	
Amœbic dysentery	..	..	..	..	..	..	..	..	..	4	
Malaria	..	..	..	..	..	..	..	..	..	4	
Tuberculosis	..	..	..	..	..	..	..	..	..	40	
Leprosy	..	..	..	..	..	..	..	..	..	1	
Aortic insufficiency	..	..	..	..	..	..	..	..	..	1	
Cirrhosis of liver	..	..	..	..	..	..	..	..	..	1	
Diabetes insipidus	..	..	..	..	..	..	..	..	..	1	
Beri-beri	..	..	..	..	..	..	..	..	..	1	
										Total	73

It will be noted that a number of diagnoses are strange ones for the fighting soldier age-group. This was due to the Japanese policy of regarding any Dutchman who had donned the Queen's Uniform at any time in his life, as being a member of the forces. There was one period in the St. Vincentius Hospital when there were over 400 patients over the age of 55, 70 were between 65 and 75, and a few were over 80, one patient being 88 years old. A similar policy was adopted for patients in the mental hospital and leprosy hospital in the Batavia area, and where any connexion with the Dutch Forces could be proved they were transferred to the P.O.W. hospitals. The probable reason for this policy was the fear the Japanese had of anyone with military training leading the Javanese in revolt against them.

As can readily be understood with nearly half our patients coming from this age-group, our problems in treatment were much increased.

Altogether some 60,000 Ps.o.W. passed through Batavia leaving behind their sick and aged, on an average there were 14,000 Ps.o.W. in camps in the city or its environs.

That there were so few deaths was due to the supply of medical stores from the civilians, arranged in a clandestine manner and supplied for many months from a city where officially no medical stores existed, and later the arrival of Red Cross Stores. The cultivating of a large garden which supplied 134 meals for the whole hospital, and in addition furnished a daily supply of 200 tomatoes and a quantity of peanuts. Finally must be mentioned the extreme hard work of the staff and co-operation of the patients.

The hours of work for the nursing staff were exceedingly arduous, 7 a.m. till 10 p.m. and every third night, night duty from 10 p.m. to 3 a.m. or 3 a.m. to 7 a.m. No time was given for making up sleep the next day. When the large drafts of patients came in it meant continuous day and night work for everyone for five days and then gradually slackening off (during this period orderlies lost from 6 to 12 kilos (12 to 24 lb.) in fourteen days). The standard of nursing was high, although medically there was such a high proportion of paralysed patients there was never a case of a bed-sore contracted in the hospital. Before sufficient commodes had been built to supply the wards and before the arrival of sulphaguanidine, an orderly on night duty marked down the number of times he carried two bed-pans to the sluice to be cleaned, 243 times and the distance that he walked was 19,440 yards between 10 p.m. and 7 a.m. Night duty was maintained during slack periods because it was necessary to give a feeling of security to the patients as the Japanese who lived in the same building invariably arrived back at night in a drunken condition. All bed patients were bathed every day and shaved every second day. During the busy periods 20 per cent of the patients required feeding and 80 per cent required lifting on and off bed-pans.

The maintaining of the health of a staff worked as hard as that demanded special consideration. All members were examined once a week and a chest X-ray carried out on the slightest suspicion of ill-health. The work of Aapsmeer on enlargement of the heart in beri-beri and Wenckebach's radiological discoveries that it is the right side of the heart including the conus arteriosus that

is enlarged, was taken as our guide in assessing a man's fitness for hard work [4]. There was no doubt about the value of the X-ray in this respect. Once a month all orderlies did a spell of duty with the working party as a "rest cure," to be in the open, and to relieve the monotony of ward work. All heavy physical labour was shared by everyone, including the doctors, this included polishing the floors, general cleaning of the hospital, heavy work in the gardens, carrying of water, laundry work, carrying of patients to and from the clinic for treatment. All doctors acted as nursing orderlies. If it could be arranged no group of men would carry out heavy work for a period of more than five days. This sharing of the heavy work proved its value in a number of ways, but two of the most important were, the doctors, the orderlies, and working party, had a much greater appreciation of the work the other man had to do, and it produced from a staff consisting of Dutch, Australians, Americans and British from all Services, a co-operation and loyalty on behalf of the sick, that was supreme.

The sanitary squad for the hospital consisted of an Australian Sjt.-Major, U.S. Navy Warrant Officer, Dutch Army Sjt., and an R.A.F. Corporal, they were all men who were intelligent, and were responsible for keeping the hospital area clean outside the wards.

The hospital and its grounds were kept in a spotless condition, mainly due to the efforts of the sanitary squad. All hospital verandahs were scrubbed down twice daily, the lavatories which had been built to accommodate about 200, required hourly attention, seldom was there cause for complaint in that direction. In addition they encouraged and cajoled all ranks to wash their hands after making use of the lavatory. They maintained the water supply by filling all containers, as the pipe supply was intermittent, and they checked and took any necessary action on water containers breeding mosquito larva.

Each ward was cleared of beds and other furniture once a week. These were cleaned and aired on an open field; steam was used for killing bed-bugs, mosquito nets and other infected articles were passed through a disinfecter. If necessary beds were taken to pieces and steamed. All inside floors were kept highly polished by using the coconut fibre issued for making bread; bare feet or soft slippers only were allowed to be worn in the wards. These efforts cut down the risk of cross infection in the wards from droplet infection, and bacillary dysentery and amœbic dysentery infection from dust and dried excreta to a minimum.

From time to time there were fly epidemics, due to the Japanese guards emptying the septic tanks (in order to obtain manure), which were situated in two quadrangles in the centre of the hospital. Any other fly breeding sources we could control, but the only method that achieved success with that particular source was combined fly swatting. This was carried out by everyone who could wield a fly swat for fifteen minutes before the midday meal and after the evening meal. As much as 10 kilos of flies per day were killed in this way, and fourteen days generally saw the end of the nuisance.

The above work has been described in some detail because it is desired to stress the educative value it had on patients and staff alike. Those not so well versed in ordinary everyday hygiene soon copied those that were, for

example it was automatic for a doctor to wash his hands after any menial task and if the work was heavy to take a shower or a wash down.

The surgery department of the hospital carried out 180 major operations, laparotomies, perforations of the stomach or duodenum, and appendicitis, formed the bulk of the surgical emergencies. There were two cases of fracture of the skull, six cases of stomach resection and a number of gastro-enterostomies, gall-bladder resections and two cases of thyroidectomy. The kidney cases were left untreated, except for one case of pyonephrosis owing to the impossibility of carrying out function tests. One surgical operation which was carried out on three occasions and met with success, was the lengthening of flexor tendons in the legs of men who were fixed in the sitting position, and who after an extended trial of weight extension and physiotherapy had not improved. In these cases the total flexor muscle group of the legs was about $\frac{1}{8}$ in. in diameter and as hard as whipcord.

In the cases where open ether was not used a spinal anaesthetic combined with some form of premedication was employed. A sterile solution of novocain with 2 to 3 drops of 1/1,000 adrenaline was added for length of effect. The usual dose was 8 c.c. of 8 per cent novocain which is 160 mg. of novocain and represented a great saving compared with local infiltration methods.

Instruments were old, or else made by the blacksmith or tinsmith with the exception of a few that it had been possible to purchase. Of the many improvisations for suture material parachute cord silk was the best. It was boiled and placed in alcohol. There was a high proportion of wound infections, 15 per cent, but none gave rise to serious trouble.

The dental department was a feature of the hospital, and the majority of the British soldiers required a great deal of attention to their teeth. The record of attendances and treatment given is explanatory of the work done:

Patients	1,380
Attendances	4,976
New plates (aluminium)	107
New plates (silver)	5
Repairs (rubber)	186
Inlays (direct and indirect)	150
Full crowns (casted)	21
Splint (with inclined plane)	2
Extraction	1,010
Filling (amalgam and phosphate cement)	2,019

It was the dental officer's opinion that dental caries was not increased during that time of bad feeding.

All of the dental mechanical laboratory equipment was improvised with the exception of a broken vulcaniser. After much experimentation the aluminium plates were made with a hard finish and were very comfortable to wear. The "silver smile" became quite famous.

The ether was made on the premises, the Japanese supply was infinitesimal and in many cases had deteriorated, certainly one of the surgical deaths was due to it. After three months of experimentation pure absolute alcohol was

obtained by fermenting katchang vijau or dedek (rice polishings) with sugar. Sulphuric acid much adulterated was bought through the black market and some was stolen from accumulators. This supply was purified and using any bit of glass tubing we could obtain, a still and condenser tube which passed through an old refrigerator was rigged up. As the water supply was intermittent, running water through the condenser tube was carried out when necessary, pouring water by hand. It was three months before the Dutch scientist was satisfied as to the purity of the product and that the technique for recovering the sulphuric acid was adequate. This ether was excellent in every way and its regular supply gave great confidence to the surgeons and anaesthetists in their work. The "back-room" department also recovered the barium sulphate from each patient after the barium meal X-ray. From an original supply of 800 gm. of barium sulphate in January 1944, there was 600 gm. of barium in April 1945, and many barium meals had been carried out. This department also made autolysed yeast which appeared to be far more effective in treatment than ordinary yeast.

Distilled water was made in the dispensary, salt was purified and isotonic saline solutions made. All vitamin-B tablets were broken down into solutions and given by injection, the giving of them by mouth seldom produced any effect. Hawes is quoted in Manson's Tropical Diseases as originally demonstrating that active extracts of vitamin B, when given by mouth are destroyed in the stomach [5]. This was considered to be one of the major factors in the rate of recovery and low death-rate which was attained.

A blood transfusion unit was maintained, blood being offered on a voluntary basis from members of the staff. All members were typed, their blood tested for syphilis and if there was a history of malaria the patient received quinine at the same time.

Soap was issued on only two occasions by the Japanese, soap was made by boiling vegetable oil, generally rancid, with an alkali. Wood ash was tried as the source of alkali but was never a success, until a proportion of ammonia was added to it. Ammonia was extracted from urine. This became a thriving industry in a near-by camp, where it was made in metal containers heated by tapping the electric wires. Tooth powder was made from charcoal. Tooth-brushes, out of wood and fine bristles of bamboo or old clothes-brushes or boot-brush bristles were used. Razors were either old razor blades resharpened or ordinary knives sharpened. It was interesting to find that a keen edge was produced on a stainless steel knife. Spectacles were made by grinding by hand the middle section of glass of a triplex windscreen, frames were old ones repaired with acetone or new ones made from aluminium. Artificial limbs from papier mâché and glue, or leather and aluminium. It was the proud boast of St. Vincentius that every man who returned from the labour camps could be equipped regarding toilet requisites and eating utensils, clothing, footwear, and headgear in spite of the infinitesimal supply from the Japanese. Rehabilitation and occupational therapy played a great part in the production of many of those articles. Patients were encouraged and taught to make their own clothes as a method of treatment for paralysed wrists or stiff fingers.

The majority of the patients identified themselves with the hospital and the work it was trying to do. This made it relatively easy to educate them in all ways, but in particular in thought for each other. Discipline was of a high order but it was not achieved by orders; understanding, education and example were the main factors in achieving a "live" discipline.

There is not space to describe that most important work but in conclusion mention will be made of the rehabilitation of an unfortunate man who had lost both of his eyes, and both arms from just above the elbow-joint in an explosion. It was six months before he comprehended his plight. Artificial arms with a joint and detachable end-piece were made of aluminium (the Dutch water-bottles and mess-tins were of this metal), leather and webbing equipment. A stick could be fastened in the end, or a spoon, or a cigarette. He was taught to read braille script with his nose, the script was about twice the normal size. This was done because there was another man who had lost his sight in the same explosion and we wanted him to realize that he was as capable of learning braille as any other blind man. He was included on my office staff and acted as a "runner," later he worked in the dispensary where he ground up leaves and herbs grown in the medical section of the garden. Pestles were made to fix in the ends of the arms. He acted as "Drill Sjt.-Major" to the men who were learning to walk, the psychological effect on these men in being taught by someone, who was so obviously worse off than they thought themselves to be, was most beneficial. He was paid out of our special fund for his work and thus became independent. It was gratifying to discover that within a year of returning home St. Dunstan's had thought fit to allow him to manage a haulage contractor's business.

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- [1] Field Service Hygiene Notes, India, 1945. Para 135.
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- [3] LEIGH, A. D. (1948) *Lancet*, February 21, p. 277.
- [4] AAPSMEER and WENCKEBACH. Manson's Tropical Diseases. 12th Edition, Chapter XXIV, pp. 423-424.
- [5] HAWES. Manson's Tropical Diseases. Chapter XXIV, p. 431.



Clinical and Other Notes

QUEEN MARY'S HOUSE



THE first Queen Mary's House has been flourishing near Fleet for some years. Recently the second one has been opened at Hollington Park, West St. Leonards.

This house was formerly a boarding school for boys under the name of St. Michaels before it was bought with money provided by Her Majesty Queen Mary to establish and endow a second home for retired members of the Q.A.I.M.N.S. (now the Q.A.R.A.N.C.).

It is run very much on the lines of a residential club. There are sixteen rooms for residents, excluding the Warden's accommodation which is a bedroom and a combined office-sitting room. There are also four visitors' rooms for either serving or retired nursing officers, or for friends of the permanent residents. There is garage accommodation and a separate house for the three resident domestic staff.

The Warden is a retired member of the Q.A.I.M.N.S.—Miss M. Bremner, R.R.C., to whom application should be made if it is desired to book a visitor's room or to visit the house.

Each resident furnishes her own room. Hot and cold water are laid on to each bedroom. There is also a gas-fire and a gas-ring. The dining room and

reception room are equipped through Queen Mary's House Fund and also by many gifts from H.M. Queen Mary and other private gifts sent since the house was practically re-built and re-decorated.

The house stands in a very charming garden with two tennis courts, a large kitchen garden, and a small orchard. It is in a very pleasant part of St. Leonards—Hollington Park—and there are some lovely beauty spots near-by. There are good transport facilities to other S.E. Coast towns while the local buses to the town and sea front stop close to the house.

Dame Louisa J. Wilkinson, *D.B.E.*, *R.R.C.*, retired Matron-in-Chief, Q.A.I.M.N.S., has done a tremendous amount of work in getting this second Queen Mary's House established. She is the Honorary Secretary of Queen Mary's House Fund which is now administered through the Queen Alexandra Royal Army Nursing Corps Regimental Association of which Dame Louisa is Chairman and Administrator.

Reviews

GERMAN-ENGLISH MEDICAL DICTIONARY. By F. S. Schoenewald. H. K. Lewis. Price 27s. 6d.

German-English Medical Dictionary by F. S. Schoenewald, M.D. Berlin, with an introduction by Professor Samson Wright. The author found sanctuary from Nazi Germany in this country, and compiled this work which will be of great value to research worker and general medical reader alike. D. F.

A SHORT PRACTICE OF SURGERY. Eighth Edition in 5 Parts. By Bailey and Love. H. K. Lewis & Co. Parts 3 and 4. Price £2 12s. 6d. (not sold separately).

Part 3 deals with the rectum, the genito-urinary tract, hernia and the skin.

Part 4 with neurosurgery, the breast, thorax, larynx and infections of the hand.

The section on the genito-urinary tract is particularly good. The illustrations are again of excellent quality throughout. The text is clear and well set out. These two parts are very readable. D. C. McC. E.

AN INTRODUCTION TO PHARMACOLOGY AND THERAPEUTICS. Eighth Edition. By J. A. Gunn, *C.B.E.*, M.A., M.D., D.Sc., F.R.C.P. London: Oxford University Press. 1948. Pp. 301. Price 8s. 6d.

The rapid strides being made in Pharmacology and Therapeutics and the recent revisions of the Pharmacopœia of the United States (1947) and of the British Pharmacopœia (1948) have called for a new edition of this popular

work. It achieves brevity by the arrangement of its subject matter and mention only of the more important official preparations. While it is essentially a manual for the previously uninitiated student, it can be highly recommended to refresh the minds of those whose undergraduate days are over. It will achieve this in a manner which will give pleasure to those who choose to use it for such a purpose.

J. B.

AVIATION MEDICINE IN ITS PREVENTIVE ASPECTS. AN HISTORICAL SURVEY.
By John Fulton, *O.B.E.*, M.D., D.Sc. London : Oxford University Press.
1948. Pp. 174. Price 12s. 6d.

This work is a publication of the Heath Clark lectures, 1947, delivered at The London School of Hygiene and Tropical Medicine. Historical surveys are given of the development of our knowledge of oxygen, altitude sickness and acclimatization, decompression sickness, pressure cabins and explosive decompression and effects of acceleration. The evolution of safety devices is then traced. Such aspects of aviation medicine as night vision, personnel selection and control of the spread of disease are not dealt with. The work merits the attention of a wide circle of readers for its own sake, as a record of research achievement and for the interesting narrative in which the underlying physiological principles discussed are clothed.

J. B.

AN ELEMENTARY ATLAS OF CARDIOGRAPHY. By H. Wallace-Jones, M.D., M.Sc., F.R.C.P. ; E. Noble Chamberlain, M.D., M.Sc., F.R.C.P. ; and E. L. Rubin, M.D., F.F.R., D.M.R.E. Bristol : John Wright & Sons, Ltd.
London : Simpkin Marshall (1941) Ltd. 1948. Pp. 108. Price 29s. 9d.

This work replaces that by the same authors on electrocardiography published in 1939, and consists very largely of electrocardiograms and radiographs of the chest representative of the commonly occurring variations from normal of significance for clinical cardiology. The legends are detailed thereby enabling the authors to cut down the general text. Despite the brevity of this, however, it is a clear exposition of fundamental knowledge necessary for an understanding of the formation of the electrocardiogram and an appreciation of the anatomical factors of importance in cardiac radiology. Mastery of this work will meet the needs of most readers and yield much economy of time for reference.

J. B.

AN INTRODUCTION TO CARDIOLOGY. By Geoffrey Bourne, M.D., F.R.C.P.
London : Edward Arnold & Co. 1949. Pp. 264. Price 18s. net.

This new work aims at contributing a sense of shape, form and general principles to the subject matter of cardiological studies. After a preliminary chapter dealing with examination of the case, the nature, symptoms, signs and treatment of heart failure are described as the main presenting problem. The causes which may produce this condition are then dealt with. A final section contains an assortment of very useful information bearing on the heart in pregnancy and in general medical diseases, effort syndrome and cardiac

signs in symptom-free young adults. While the system tends to divorce certain conditions from their usual clinical context, e.g. paroxysmal dyspnoea and oedema of the lungs from left ventricular hypertrophy, the exposition is on the whole clear and concise. An adequate selection of well-chosen radiographs and electrocardiograms add to the completeness of the presentation. The author is to be congratulated on producing a complete work smaller than most which cover the same range, and one which can be strongly recommended to give a balanced view to his subject.

J. B.

REVIEW OF COMMANDO MEN. By B. Somain. Stevens & Sons, Ltd.

This is an account of the operations of 45 (Royal Marine) Commando in N.W. Europe. This Commando was one of the four units of First Special Service Brigade (afterwards renamed First Commando Brigade) which landed in Normandy with 3 British Division in the early hours of June 6, 1944.

This Commando saw fighting in N.W. Europe from D day to VE day, except for a period of four months' refit in U.K. between September 1944 and January 1945. The narrative records the part played by the unit in the fighting in Normandy, in Holland and in Germany. It is a stirring account throughout, told with a proper modesty.

R. D. C.

Notices

TOBRUK 1941

THE Third "Tobruk 1941" Officers' Dinner will be held at The Connaught Rooms, Great Queen Street, Kingsway, London, W.C.1, on Friday, November 18, 1949.

Particulars from Major-General C. E. N. Lomax, *C.B.*, *C.B.E.*, *D.S.O.*, *M.C.*, Four Winds, Craigwell, Bognor Regis, Sussex.

NEWTON DRIVER SERVICES' CLUB

THE Newton Driver Services' Club traces its origin back to the dark days of the recent war when, as the English Speaking Officers' Club in London, it offered a home and social club to officers of our own three Services, and to those from the Dominions and the United States of America.

Its successor—the Newton Driver Services' Club—provides a residential club for injured or convalescent members and ex-members of the three Services, in particular for those who were casualties or prisoners during the 1939–45 War. It also provides a "complete and restful holiday in delightful surroundings for any Service man who is feeling jaded and in need of a tonic and change to compete with the difficulties of this present life."

There is accommodation for 40 guests and for older members of the

Services—or members with wives—there are four special self-contained suites.

For recreation there are bathing from the private beach, a miniature golf course, the sports deck, games room, a large library, a carpentry and boat-building shop, a large gymnasium as well as near-by excellent golf courses, tennis, bowls, sea and river fishing and boating and every other sports facility.

There are ample facilities for day members and Services hospitals are encouraged to send parties to spend a day by the sea.

The catering is of a very high standard. This is a non-profit-making club and the charges are based on what is considered essential for just clearing expenses.

Mrs. Newton Driver, the Chairman and Founder of the English Speaking Officers' Club, and now of this club, has put her entire home and everything she has into this club which she feels will be a never-ending requirement and which she would like always to be continued and to remain as a tangible and lasting memorial to the untimely loss of her husband.

Full details concerning terms, etc., may be obtained from Mrs. Newton Driver to whom applications for accommodation should be made. The address is: The Newton Driver Services Club, Rustington, Sussex. The nearest station is Angmering, at which station trains will be met by car. Telephone: Rustington 377 and 1444.

R.A.M.C.—CORPS TIE

It has been decided that the following will be regarded as the official description of the Royal Army Medical Corps regimental tie:

Colours: Dull cherry, blue and old gold. (These colours were officially approved for the Corps flag by our Colonel-in-Chief.)

Design: Equal diagonal stripes, each stripe $\frac{7}{8}$ inch wide. Stripes are in the following sequence:

Blue.

Old gold

Blue.

Dull cherry.

The stripes, facing the wearer, run from "North-East" down to "South-West."

Note.—This settles an old argument as to whether the Corps tie is an officers' tie. It is definitely a *Regimental Tie* and as such may be worn by all ranks who are serving, or who have served, in the R.A.M.C. whether Regular, Territorial or Emergency.—EDITOR.

15 (S) DIV. MEMORIAL

GENERAL SIR RICHARD O'CONNOR will unveil the 15th Scottish Divisional Memorial which is being erected at Tourville-sur-Odon, near Cheux, Normandy, on Sunday, June 26, 1949, the fifth anniversary of the Division's first battle.

It is probable that an organized party will leave London about 9 p.m., Friday, June 24, and arrive back in London about 7 a.m., Tuesday, June 28.

Will those who wish to attend please notify

Brigadier R. M. VILLIERS, *D.S.O.*,
Headquarters,
Northumbrian District,
Darlington,
Co. Durham,

as soon as possible. Full details, including cost, will be sent out as soon as possible.

Extracts from the London Gazette

LIST 1

(1) *R.A.M.C.*

(a) Promotions

- | | |
|--|-----------------|
| (i) Lt.-Cols. from R.A.M.C. to be Cols. | |
| P. F. Palmer, <i>O.B.E.</i> , M.B. | 1st Mar. 1949. |
| D. Bluett, <i>O.B.E.</i> , M.B. | 5th Mar. 1949. |
| E. C. Eccles, M.B. | 21st Mar. 1949. |
| (ii) Majors to Lt.-Cols. | |
| R. H. Hunt, <i>O.B.E.</i> | 18th Feb. 1949. |
| R. J. Pryn | 1st Mar. 1949. |
| P. L. E. Wood, <i>D.S.O.</i> , <i>M.B.E.</i> | 5th Mar. 1949. |
| G. M. Denning | 8th Mar. 1949. |
| J. J. Sullivan | 21st Mar. 1949. |
| (iii) Capts. to Majors | |
| R. N. Vanreenan, M.B. | 27th Feb. 1949. |
| (iv) Capts. (Qr.-Mr.) to Major (Qr.-Mr.) | |
| W. J. Jolly, <i>M.B.E.</i> | 13th Mar. 1949. |
| A. W. Langley | 26th Mar. 1949. |

(b) *Retirements*

- | | |
|---|-----------------|
| Lt.-Col. J. J. O'Dwyer, <i>C.B.E.</i> , M.B. | 8th Mar. 1949. |
| Col. (Temp. Maj.-Gen.) E. B. Marsh, <i>M.C.</i> , M.B., <i>M.R.C.P.</i> | 11th Mar. 1949. |
| Col. J. Biggam, <i>M.C.</i> , M.B., <i>K.H.S.</i> | 1st Jan. 1949. |
| Col. A. R. Ross, M.B. | 21st Mar. 1949. |
| Col. W. M. Cameron, <i>C.B.E.</i> , M.B. | 24th Mar. 1949. |
| Lt.-Col. L. S. C. Roche | 27th Mar. 1949. |
| Lt.-Col. R. R. Leaning, <i>O.B.E.</i> | 29th Mar. 1949. |

(2) *R.A.D.C.*

Retirements

- | | |
|-----------------------|-----------------|
| Col. J. Mc.L. Foreman | 12th Mar. 1949. |
|-----------------------|-----------------|

(3) Q.A.R.A.N.C.

(a) Promotions

- | | |
|-----------------------------------|-----------------|
| (i) Junr. Comd. to be Senr. Comd. | |
| L. M. Rose, <i>R.R.C.</i> | 9th Mar. 1949. |
| (ii) Subs. to be Junr. Comds. | |
| A. Flahagan | 4th Feb. 1949. |
| M. L. Holt | 6th Feb. 1949. |
| B. M. Gordon | 13th Feb. 1949. |
| E. Ballesty | 20th Feb. 1949. |
| W. J. Kirkwood, <i>A.R.R.C.</i> | 28th Feb. 1949. |

(b) Retirements

- | | |
|---------------------------------|----------------|
| Matron F. Holmes, <i>R.R.C.</i> | 9th Mar. 1949. |
|---------------------------------|----------------|

LIST 2

(1) HONOURS AND AWARDS

(a) R.A.M.C.

- (i) Mentioned in Despatches in recognition of gallant and distinguished service in Malaya during the period July 1, 1948 to December 31, 1948.
- Major E. L. O. Hood, M.B.
 Capt. G. D. Powell, M.B.
 19175339 Pte. P. Andrews
 19196697 Pte. J. Brothwood
- (ii) Awarded Long Service Medal (Military) without gratuity (date of qualification is shown in brackets)
- Lt. (Qr.Mr.) (now Hon. Capt.) R. F. Harder (July 4, 1944)
 Lt. (Qr.Mr.) (now Hon. Lt.) J. H. High (August 6, 1948)
 Lt. (Qr.Mr.) (now Capt. (Qr.Mr.)) H. E. Skelton (November 10, 1944)
 Lt. (Qr.Mr.) (now Capt (Qr.Mr.)) R. J. Thomson (January 17, 1944)
 Lt. (Qr.Mr.) F. E. Woodhams (July 14, 1948)

(b) R.A.M.C.(T.A.)

The King has been graciously pleased to confer the Efficiency Decoration upon the following officers of the Territorial Army:

Major J. W. L. Bain
 Major C. K. D. Edwards
 Major F. A. Edwards
 Major B. F. Longbotham
 Major B. L. McQuillan
 Major P. D. Thomson
 Major D. S. Valentine

(c) Q.A.R.A.N.C.

Senior Controller Anne Thomson, *C.B.E.*, *R.R.C.*, Matron-in-Chief, Q.A.R.A.N.C., is appointed Honorary Nursing Sister to The King, April 2, 1949.

(2) PROMOTIONS

(a) R.A.M.C.

- (i) Lt.-Col. from R.A.M.C. to be Col.
- | | |
|---|--------------|
| F. M. Richardson, <i>D.S.O.</i> , <i>O.B.E.</i> | Apr. 4, 1949 |
|---|--------------|
- (ii) Majs. to Lt.-Cols.
- | | |
|--|---------------|
| R. E. Waterston, M.B., <i>F.R.C.S.</i> | Mar 29, 1949 |
| H. N. Perkins, M.B. | Apr. 3, 1949 |
| J. L. Gordon, <i>O.B.E.</i> | Apr. 4, 1949 |
| R. J. G. Morrison, M.D. | Apr. 22, 1949 |

June, 1949.

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EDITOR

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ASSISTANT EDITOR

LIEUTENANT-COLONEL J. C. BARNETSON, *O.B.E.*, R.A.M.C.

MANAGER

MAJOR W. R. WEST-WATSON, *M.B.E.*, R.A.M.C.

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Journal of the Royal Army Medical Corps.

Original Communications

RODENTS IN RELATION TO DISEASE AND THEIR CONTROL

BY

Captain L. J. HARRISON
Royal Army Medical Corps

Rats !

*They fought the dogs and killed the cats,
And bit the babies in the cradles,
And ate the cheeses out of the vats,
And licked the soup from the cook's own ladles,
Split open the kegs of salted sprats,
And even spoiled the women's chats,
By drowning their speaking,
With shrieking and squeaking,
In fifty different sharps and flats.*

("The Pied Piper of Hamelin," by
R. BROWNING.)

(1) THE RAT MENACE

RATS affect the well-being of man in many ways : they foul and destroy food and crops ; they harass poultry ; they burrow and tunnel in buildings and have even been known to be the cause of fires by gnawing through electric cables and gas pipes.

Not only do rats destroy the material wealth of man—the damage is estimated at £15,000,000 yearly in Great Britain alone—but they also suffer from certain diseases to which man is susceptible.

The importance of the recognition of rats as vectors of disease and as an agency in the destruction of food supplies has long been realized by those connected with their eradication, but the general attitude is one of indifference. War stresses the importance of conserving foodstuffs and the protection of the individual against disease, and this article is intended to assist in the identification of the rat, its habits, diseases spread, and methods of control.

(2) RAT-BORNE DISEASES

(a) *Plague*.—The most dreaded disease associated with rats is plague. Plague has been known as "The Black Death" and two great epidemics have swept Europe; one in the 1350s when one-quarter of the European population were victims, and again in 1665 when 70,000 died out of the total inhabitants of 460,000 in the Plague of London. Nowadays it is localized in certain areas, mainly in the tropics and sub-tropics.

There are two types of Plague:

(1) *Bubonic Plague*: When a rat is suffering from plague, the fleas which feed upon it become infected and since plague is as fatal to rats as it is to man, the infected rat usually dies.

Normally, the flea will leave the dead rat immediately its body is cold, and will then find a new rat host. This will continue until about 20 per cent of the rat population have become victims to the disease, and then the fleas will vacate the rats and seek new hosts—usually man.

When the fleas have been successful in their search, they start to feed on the human host.

The man is thus bitten by the infected flea and develops plague.

(2) *Pneumonic Plague*: In the pneumonic form of plague, the septicæmia with *B. pestis* has resulted in a massive involvement of lung tissue.

This form of the disease is invariably fatal and the sufferer is a constant source of droplet infection to the community.

(b) *Murine Typhus*.—An infection which occurs in rats and man. It is a mild form of typhus which is passed from rat to rat and from rat to man by the rat flea or rat louse.

In man it causes scattered cases of typhus, but no large-scale epidemic such as occurs with louse-borne typhus has ever broken out.

Even so, in some countries it is important—for example, in the U.S.A. in 1937 there were 3,000 cases with some 200 deaths.

(c) *Weil's Disease*.—Sometimes known as spirochætal jaundice is caused by a spirochæte, which lives harmlessly in the kidneys of rats and is passed out in their urine.

Man becomes infected through contaminated cuts and abrasions by water which has been fouled by rats' urine, or by consumption of similarly contaminated water or food. The disease is associated mostly with coal miners, sewer workers and fish girls.

(d) *Rat-bite Fever*.—The germ is inoculated by the bite of an infected rat. It is particularly common in Japan; but can occur wherever rats exist.

(e) *Trichinosis*.—This is a worm disease, particularly common in certain parts of Europe. The worm encysts in the muscles of rats and pigs; man develops the disease after consuming raw or imperfectly cooked infected pork.

(f) *Amœbic Dysentery and Food Poisoning*.—It has been proved that both of these diseases have been spread by contamination of food supplies by rats.

Such then, is the indictment of the rat—and it is obvious from the above diseases that the rat should and must be eliminated. To do this, the habits.

ways of life, and species of rats must be studied so we shall next consider the two common species which are to be found all the world over.

(3) THE BLACK RAT AND THE BROWN RAT

Character	Black rat	Brown rat
(1) Name	<i>Rattus rattus</i>	<i>Rattus norvegicus</i>
(2) (a) Size	Small and slim	Large and fat
(b) Weight (full size)	Approx. $\frac{1}{2}$ lb.	Approx. 1 lb.
(3) Head		
(a) Muzzle	Sharp, pointed	Blunt
(b) Ears	Large and thin. Hairless. Semi-transparent. When pressed forward, cover the eyes	Small, thick and hairy. When pressed forward, do not cover the eyes
(4) Body (female) ..	10 teats	12 teats
(5) Tail	Thin, long ; as long as, or longer than, length of head and body	Thick, short ; shorter than length of head and body
(6) Habits	Climber. Domestic rat in houses and ships	Swimmer found in houses, sewers and fields.
(7) Droppings.. ..	Sausage shaped and scatered	Spindle shaped, clustered

The colour of a rat is no guide to the species, since over 1 per cent of brown rats are black, and the black rat exists in two other forms which are brown. Although widely distributed the black rat is more common in the warmer parts of the world whilst the brown rat inhabits the temperate zones. The black rat is thought to have been brought to Great Britain during the thirteenth century in the ships of the returning Crusaders. Quickly spreading, the rats infested everywhere, until the eighteenth century, when the brown rat was accidentally introduced, the latter, however, soon gaining ascendancy over its rival. In this country at present, the black rat is restricted to the environs of the great ports, whereas the brown rat is almost everywhere.

In foreign countries, other species of rats with different habits are sometimes found, i.e. *Rattus concolor* in Burma. Full details of these can be obtained from the reference books mentioned at the end of this article.

(4) THE HABITS OF RATS

(1) *General*.—Brown rats burrow and make nests for themselves in or near the ground in dry or well-drained situations such as rubbish dumps, hayricks, and in the earth beneath buildings. Being strong swimmers, they also inhabit the banks of canals and rivers. They readily come inside to live providing they are able to find suitable places to burrow, i.e. among sacked goods in ware-

houses or granaries, and under floorboards. Although capable climbers, they are usually more common on ground floors than on the upper floors of buildings.

Black rats do not burrow but nest in sheltered situations provided by man, i.e. spaces behind bulkheads in ships, wall cavities, ceilings and roofs of houses. They are excellent climbers and consequently common in upper stories of buildings. Being such good climbers they are capable of going to and fro from ships to shore by the cables tying them up : thus the use of rat shields on ships' cables, preventing rats leaving a ship and getting ashore. The black rat lives in close association with man, only rarely being found out of doors in this country.

(2) *Food*.—Rats sleep in their nests during the daytime and at night come out in search of food and water. Being very conservative in their habits, they follow definite “ runs ” to their feeding places where they fill their mouths with food and return to masticate it. During the night there are three to four feeding periods, each lasting one to one and a half hours. For the remainder of the evening they wander round in search of new feeding places.

One habit that often betrays their presence is the gnawing of a hard substance ; this being essential in order to limit the length of their persistently growing front teeth.

A rat always avoids objects sited in unfamiliar positions—irrespective of their nature. For example, a rat finding a new feeding place will avoid it for the first night, but on the second and third nights may eat a little. Eventually, when the rat has become fully used to the food supply, it will eat its fill.

This behaviour is of the utmost importance, especially when using poisons or traps. It must be realized that should the position of a bait or trap be altered, then the rat will regard it as a new object and in consequence will avoid it.

(3) *Breeding*.—The breeding season of rats extends throughout the year but there are two intense periods—one in spring and the other in autumn. Thus every effort should be made to exterminate rats in February to March, and August to September, since every rat killed then is equivalent to four or five killed in May to October.

The Female Rat : The female rat may be sexually mature when three and a half or four months old, and they can breed all the year round. The sexual season for a particular female extends for about nine months, and “ heat ” occurs at intervals of about ten days. The male is always ready to pair ; the female cannot be impregnated except at the period of “ heat ” which lasts for only a few hours. The period of gestation is about three weeks, and the female is ready to be impregnated within a few hours of the birth of a litter. The average number in a litter is eight, but there are often a dozen ; and there may be five or six litters in a year. The female ceases to be fertile as she grows older—a fact sometimes overlooked in estimating the rate of multiplication. She is a careful mother, but in conditions of overcrowding, inadequate food supplies, or captivity, she may devour her offspring. The young are born blind and naked, with their ear-trumpets sealed down ; their eyes open in about a fortnight and they are weaned in the course of their fourth week. It will be understood that

many of the figures, such as the number of offspring in a litter, vary greatly according to the conditions of life.

The increase of rats is therefore prodigious, but this can be offset by their enemies and by shortage of their food supplies. In consequence I will now give, briefly, some of the methods used to : (a) Preserve their enemies ; (b) protect food supplies ; (c) destroy their breeding places.

(5) PREVENTION OF INFESTATION

(1) *General*.—Rats are attracted to camps and buildings but will only remain there if there are suitable food and breeding places. General preventive measures are therefore : (a) making food sources inaccessible ; (b) making buildings rat proof.

(2) *Food Stores*.—(a) Food stores should have concrete floors : if this is impracticable and floors are wooden then care should be taken to ensure that they make a tight joint with the wall. This joint can be reinforced by fixing sheet metal to cover the lower 18 inches of the wall and extending a similar distance on the floor.

(b) Metal bins with tight-fitting lids should be used for storing grain food and similar sacked commodities. Wooden bins, if used, should be covered with $\frac{3}{8}$ inch galvanized wire netting.

(c) No food should be left exposed—particularly at night.

(3) *Refuse and Swill*.—(a) Refuse will normally be disposed of in covered metal bins, which are placed suitably on hard impervious ground to prevent fouling of the surrounding area.

(b) If no contractor is available to remove the dry refuse, then it should be burnt.

(c) Swill should be disposed of to authorized contractors. If this is not possible, swill can be dried and incinerated.

(d) Both wet and dry swill can be disposed of by “controlled tipping.” All materials placed in a tip must be compressed to minimum size in order to exclude air. The tip should be covered above and at the sides with a 6 inch layer of tightly packed earth—the working face should never be left uncovered for a period exceeding seventy-two hours. This tight packing causes production of freak heat (160°–170° F.), which, apart from rotting the refuse, also destroys any rats which may have decided to nest in the tip.

(4) *Buildings—Outside*.—Successful rat proofing depends upon recognizing exactly how and where the rats enter and live in the building. This can be discovered by looking for traces (*vide* Section 6, paras. (i), (ii), and (iii)).

The following are points which should be examined :

(a) Ground floors and basement windows should be kept shut or protected by $\frac{3}{8}$ inch galvanized wire netting.

(b) Can the rats enter the building by climbing up the inside or outside water pipes? If so: (i) Fit galvanized wire balloons at the top of rainwater pipes. (ii) Place a close-fitting metal cowl into the wall and projecting 9 inches from the pipe. (iii) Seal off open cavities of walls under eaves. (iv) Build up the wall between the rafters to meet slate or tiled roof.

(c) Rats may enter alongside gas or drain pipes. Fill any gaps around pipes with concrete in which broken glass is embedded.

(d) Broken gulleys and drains should be repaired.

(e) Traps, basement doors, etc., should be protected by sheet metal.

(5) *Buildings—Inside*.—(a) Inside buildings it is best to start from the source of infestation and work outwards, rat proofing floors.

(b) Rats live in cavity walls, behind skirting boards and in spaces between ceilings and floors.

(c) Vertical and horizontal pipes give rats access from floor to floor and room to room. Seal these channels with wire mesh at ceiling level.

(d) Follow the "runs" from the centre of infestation, seal them off section by section and then rat proof them.

(6) *Natural Enemies of Rats*.—Animals which feed on or attack rats should be protected: Dogs, weasels, stoats, buzzards, hawks, kestrels, owls, ravens and seagulls.

(6) TRACES OF INFESTATION

(i) *Rat "Runs"* (*vide* Section 4, para. ii).—Take the shortest covered way between breeding places and food supplies. Rats never cross an open space.

(ii) *Smears*.—Rats run close to the wall and their greasy coats leave dark smears. These are particularly evident at any obstruction. Smears are bright and shiny when new. They are, therefore, useful in deciding whether or not a run is still in use.

(iii) *Scrapes*.—When a rat burrows or makes a hole, it heaps up the displaced material behind it. It is thus easy to decide which way the rat is tunnelling.

(iv) *Gnawing Marks* (*vide* Section 1, para. i, Section 4, para. 2).

(v) *Droppings*.—The droppings of the black rat are usually scattered, whilst those of the brown rat are restricted to certain special places. The amount of fresh excreta is a useful guide to the size of infestation. Fresh droppings are soft, moist, and shiny.

(vi) *Footmarks*.—These are a help in the recognition of "runs." They may be seen in dust or foodstuffs such as flour. If there is any doubt as to the "run" being used, whitening may be put down and the footmarks of the rats will be clearly visible if the run is frequented.

(vii) *Damage to Food*.—This may be the first indication of an infestation. i.e. spillage from grain, sugar or flour sacks.

(viii) *Estimates of Infestation*.—From examination it is possible to estimate roughly how many rats are infesting a building. Infestations are graded as under:

Over 200	Reservoir infestation
Approx. 20-200 ..	Major infestation
Under 20	Minor infestation

(7) THE CONTROL OF RATS

(1) *General*.—The general principles of rat control have one aim, namely, to kill all rats in an infestation as quickly as possible and thereby eliminate the

natural increases due to breeding. The various methods used in rodent control are described below.

(2) *Poisoning*.—(a) There are four poisons in common use—they are in order of their effectiveness against rats: A. zinc phosphide; B. arsenious oxide; C. red squill powder; D. barium carbonate.

In using any of these poisons it is essential that the following information is available:

(1) The quantity of poison needed to kill a rat.

(2) The amount of poisoned food a rat must consume to be affected.

Bearing in mind these two points, the table given below shows the percentages of poison given in baits.

(3) *Pre-baiting and Baiting*.—Rats seldom feed at new food sources until they are fully accustomed to their presence. It is thus essential that the confidence of the rat is won. This is done by “token pre-baiting.” A small amount—about 2 ounces—of unpoisoned food is put down at selected points, this being replaced by fresh baits on the second, third and fourth nights. The pre-bait is usually consumed in entirety on the last two nights. If the pre-bait is not eaten or touched by the rat a new baiting point should be selected, the former being judged as unsuitable. On the fifth night a larger quantity of bait—about 3 ounces—to which has been added poison, is laid at each baiting point. If it is found that all the poison bait is taken, post-baiting should be carried out to ensure that all the rats have consumed a lethal dose.

(4) *Post-baiting*.—Rats which have taken a sub-lethal dose of any poisoned bait may become prejudiced against this particular bait, but not against the place where they consumed it. This post-baiting treatment is carried out after the period of ten days has elapsed since poisoning. Hence the necessity for complete records of treatment (Section 7, para. b). To test for surviving rodents, a small amount—about 1 ounce of a different bait is put down and left for two or three days. If this is eaten, then a fresh treatment is necessary and this should be commenced after six days using a different poison from that used in the first instance.

(5) *Methods of Baiting*.—Baiting points should be chosen along the runs in between the holes from the breeding place to feeding place. The nearer the bait is to the hole, the more successful is it likely to be. Baits can be placed in the holes, or in definite bait containers. The latter is the better method as it diminishes the possibility of poisoning other animals or children.

For indoor baiting P.3 containers are issued (*see* figs. 1 and 2). They should be placed in position with a little dry bait scattered in the tunnel, on the baffles and inside. It takes up to ten days before the rats enter these containers. Before pre-baiting and baiting, ensure that they are being freely used by the rats.

For outdoor infestations D.1 containers can be constructed by cutting 3-inch piping into short 12-inch lengths and filling up one end with cement. They are used normally in batteries of four and can be left permanently in position (*see* figs. 3 and 4).

(6) *Composition of Baits.*—Baits are composed of a harmless base and a poison.

1. *Bait Bases.*

Damp sausage rusk : Sausage rusk mixed with an equal weight of water.

Sugar meal : 9 parts national flour. 1 part caster sugar.

Bread mash : Dry bread mixed with water to give consistency of porridge.

Soaked wheat : Wheat soaked in water, excess water being poured off.

2. *Poisons.*

Zinc phosphide : Is used at 5 per cent by weight in any base. Liberates phosphine when wetted, this gas being injurious to man and animals. This should, when possible, be mixed with dry bases. The obnoxious smell of zinc phosphide does not repel rats.

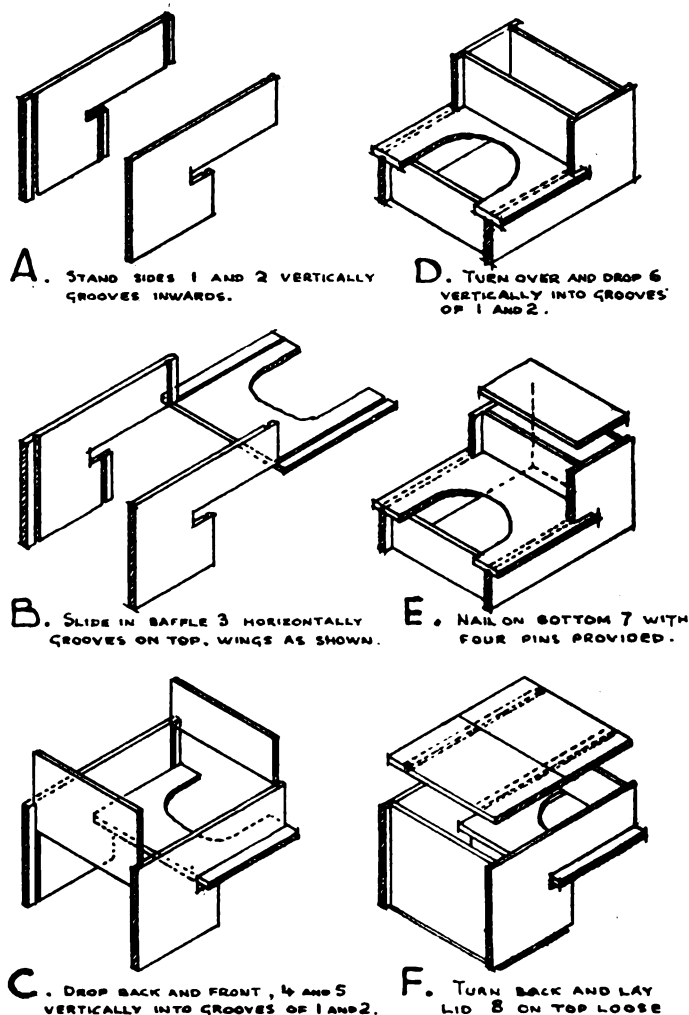


FIG. 1.—Assembly sketch of a P.3 bait container.



FIG. 2.—The bait container P.3, near rats holes in a roof.

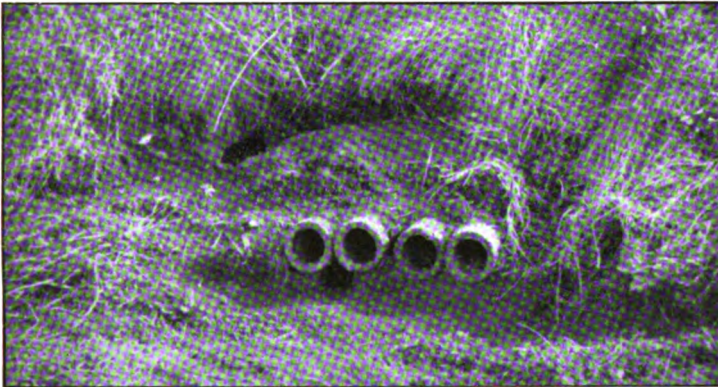


FIG. 3.—The D.1 containers. Four drainage pipes, with bait near traces and holes of rats.

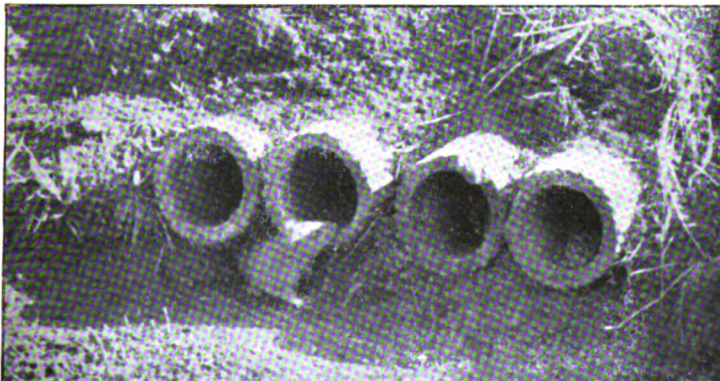


FIG.4.—D.1 containers. Brown rat entering drainage pipes.

Arsenious oxide : A white powder, used 15 per cent by weight in dry baits and 10 per cent in wet baits. To comply with rules for colouring poisons, a blue dye is usually added.

Red squill : Is supplied in both liquid and powder forms. Powder used at 10 per cent concentration. Liquid used as under :

Red squill 1 pint
Water 4 pints
Sausage rusk 9 pints

Barium carbonate : Can only be used with bread mash. It is used at 20 per cent by weight.

It is essential to mix the bait base and poison very thoroughly to ensure that the latter is distributed evenly through the bait.

TABLE I

Base	Zinc phosphide	Arsen oxide	Red squill	Barium carbonate
Damp sausage rusk	—	10 per cent	10 per cent	—
Sugar meal ..	5 per cent	15 per cent	—	—
Bread meal ..	—	10 per cent	10 per cent	20 per cent
Soaked wheat ..	—	10 per cent	—	—

Percentage expressed by weight of poisons.

TABLE II.—SUITABLE BAITS

Zinc phosphide	1	Barium Carbonate	1
Sausage rusk	10	Water	4
Water	10		
Arsenious oxide	2	Zinc phosphide	1
Sausage rusk	9	Sugar meal	19
Water	9		
Red squill	1	Arsenious oxide	3
Bread mash	9	Sugar meal	17

(7) *Poison Precautions.*—Zinc phosphide and arsenious oxide are both very poisonous to man and should be stored in a dry atmosphere. When any poison bait is laid, the following precautions will be observed : (a) Notify all concerned where the poisons have been laid. (b) Keep a clear record of all baits used. (c) All poisoned rats found should be burnt.

(8) *Gassing (a) General.*—Gassing is used to serve a rapid initial clearance when the source of infestation is in the open such as in hedgerows and in banks. On no account should this method be used for loose piles of rubbish or where there is any possibility that the rat burrows lead to human dwellings. It **MUST NEVER BE USED IN FOOD STORES OR HOUSES**. The main advantage with gassing is that the rat fleas are killed in addition to the rats themselves.

(b) *Hydrogen cyanide.*—Hydrogen cyanide gas is a valuable aid in clearing out infestations. It is highly dangerous and must be used with great care. The forms in which it is normally used are "Cymag" or "Cyanogas."

Cymag : All rat holes are blocked and on the second day a heaped teaspoonful of the powder is placed by means of a "spoon" in burrows that have been reopened. The holes should then be re-blocked. The powder gives off the lethal gas, destroying the rats that attempt to dig themselves out. The process is repeated on any holes that the rats succeed in un-blocking.

Cyanogas (U.S.A. Product) : The powder is pumped into the rat burrows.

Precautions taken when using Hydrogen Cyanide : (a) Face down-wind when placing the powder in the burrows to avoid breathing in the dust or contaminating clothing. (b) Ensure that no moisture enters the container tins during operations. (c) Close the tins after use and store in a dry place. (d) Wash the hands thoroughly.

(9) *Trapping*.—Trapping is a very useful "follow-up" measure to deal with the remnant of an infestation after poisoning. Treadle breakback traps are the best types. As the rat reacts to unfamiliar objects, traps must first be set down unset with a small amount of bait on them for three or four days. The traps should be placed in regular runs near the holes. Rats are in no ways repelled by the operator handling the traps.

(10) *Hunting*.—The use of dogs and ferrets against rats is not regarded as an effective method of control.

(8) THE CONTROL OF MICE

(1) *General*.—Mice differ from rats in two important respects. First, they are very localized, rarely moving more than 10 feet from their nests ; secondly, they are very inquisitive and do not avoid new objects, therefore traps need not be left unset.

(2) *Trapping*.—Blitz trapping is the most successful method of killing mice. Large numbers of traps should be used. They should be placed 2 to 3 feet apart, at right-angles to the run with the treadle against the wall. Good baits for attracting mice to the traps are flour, oatmeal, or breadcrumbs. Trapping fails when mice are living near plentiful food supplies.

(3) *Poisoning*.—Where there is little alternative food, pre-baiting for one night is adequate, but where there is an alternative food source, four nights pre-baiting is desirable. Put out the bait in $\frac{1}{4}$ ounce heaps. The following baits are useful : (a) Dry rolled oats. (b) Damp sausage rusk (see Section 6, para. (2)). (c) Rolled oats, 4 parts to 1 part of water by weight, arsenic at 10 per cent or zinc phosphide at 5 per cent by weight.

Mice develop poison prejudice but not bait-base prejudice. Therefore it is only necessary to change the poison and not the base for the second treatment.

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COMMON SKIN DISORDERS OF THE ARMY IN THE TROPICS

BY

Major KEMBLE GREENWOOD, M.B., M.R.C.P.Edin.

Royal Army Medical Corps

Dermatologist, FARELF

REALIZATION of my own deficiencies of knowledge on arrival in Malaya, and observation of other new arrivals, has prompted me to present this brief survey of common dermatological problems, and their management. At the Military Hospital, Singapore, there are beds for approximately 80 dermatological patients, and there is also a thriving out-patient department.

An analysis of cases over a period will give an idea of the conditions which are prevalent :

A. Patients attending as out-patients :

<i>Conditions</i>	<i>Percentage</i>
(1) Tinea corporis	20
(2) Contact dermatitis	9
(3) Foot conditions	7½
(4) Tropical acne	6
(5) Bullous impetigo	4½
(6) Dermatitis medicamentosa ..	3
(7) Prickly heat	2
(8) Urticaria	2

B. Admissions during the same period :

<i>Conditions</i>	<i>Percentage</i>
(1) Tinea corporis	28
(2) Contact dermatitis	15
(3) Foot conditions	11
(4) Tropical acne	1½
(5) Bullous impetigo	5
(6) Dermatitis medicamentosa ..	7

From the above figures it will be seen that fungus infections constitute the major problem. Furthermore, the time spent in hospital treatment is so much greater than in other conditions that the great majority of patients in the wards at any one time is suffering from fungus infections.

I have grouped foot conditions together arbitrarily, because they form a special difficulty. Under the heading are included vesicular eruptions of the feet, hyperidrosis and fungus infections.

Fungus Infections.—The high incidence of these conditions in Malaya is probably a consequence of the temperature and high humidity. It is interesting to note that the incidence in Hong Kong drops suddenly at the end of October when the winter season begins. Conditions of temperature and humidity in Hong Kong during the summer compare very closely with the all year round conditions in Malaya.

The source of the infections is obviously of importance in prophylaxis. The most common fungus is *Trichophyton mentagraphytes*. It does not seem to be an indigenous fungus, although to date no large-scale survey of civil sources has been undertaken. It seems on the whole more likely to be a variant of *Trichophyton interdigitale*, brought out to Malaya from U.K. on the feet of the European soldier. There are further facts as evidence of this, such as the frequent development of infection during transit from U.K., and the relatively high incidence of infection in troops arriving from U.K. There has been considerable work done on these infections in British troops by Sanderson, Sloper, and May, under the auspices of the M.R.C. Their work is expected to be published shortly.

Other fungus types such as *Trichophyton interdigitale*, *Epidermophyton floccosum*, and *Trichophyton rubrum* (the last mostly in Malays) are found.

Clinically the frank body infection, with widespread circinate lesions, is easy enough to recognize. There are, however, certain manifestations which do seem to present difficulties.

(1) *Kerion*.—Naturally, in a widespread infection the face may be affected. The infection may present as a typical ringed lesion which can be treated in the same manner as the body lesions. More commonly, *tinea barbæ* presents with deep-seated pustular lesions over the beard area, and the subsequent development of abscesses which may be of considerable size. These abscesses may absorb slowly, or may rupture leaving multiple small superficial sinuses, and some scarring. This is essentially what is meant by *Kerion* formation—a deep pustular reaction to a fungus infection. In addition numerous circular *kerions* will doubtless be found scattered over the body, while in the crutch, or axillæ, there may be lesions similar to those on the beard. It seems that there is the sudden development of an inflammatory reaction to the fungus, and usually this reaction is generalized. It may be associated with considerable constitutional upset and loss of weight.

The pustular *tinea barbæ* has to be differentiated from *sycosis barbæ*. There should not be much difficulty. In Malaya a pustular eruption of the beard area is likely to be a *tinea*, and if there are other pustular lesions on the body, the diagnosis is almost certain. There is usually more induration than in *sycosis*, and individual affected hairs can be lifted out without much resistance.

Kerion is described as Nature's method of effecting a cure. It is usually a reaction to an animal-type fungus. Therefore one may expect to see it in animal *Microsporum* infections in children at home, and in *Trichophyton mentagraphytes* infections in Malaya. There is an intense reaction to the hair follicle; the hair is discarded, and the infection normally cured. It is useless to apply fungicides to such lesions.

(2) *Tinea of the Feet*.—This will be considered later, but it may be noted here that a cheiopompholyx may occur in association with tinea pedis. A cheiopompholyx is common enough in the tropics, and it is difficult in many cases to prove that it is not secondary to a foot infection, because at least an abnormal toe-cleft is a commonplace in Europeans, even if this merely consists of slight scaling and maceration. The cheiopompholyx is a non-specific eczematous eruption, and there are many other causes for it. The feet may be treated by all means, but every case should not necessarily be considered an "ide."

(3) *Treatment*.—There are numerous fungicides, and numerous individual preferences. Chrysarobin and dithranol have been used over many years and found effective. Chrysarobin may be used in from 1–8 per cent strength, but for general purposes 2 per cent in Lassar's paste is a good remedy. 1 per cent dithranol is probably of equivalent value. A criticism of these drugs is that they give rise to reactions, but this need not be of serious import if certain considerations are borne in mind :

(a) The reaction is usually a direct irritant effect rather than a sensitivity. One may therefore expect a reaction if the application is applied to lesions which are already inflamed.

(b) Equally, sensitive skin, such as that in the crutch, must be treated with caution. Applications of all fungicides are liable to produce a scrotal dermatitis, and this applies even to gentian violet, used in 1 per cent watery solution. In general it may be said that the scrotum does not require treatment with fungicides.

(c) A close watch for reaction should always be kept.

Other fungicides which may be used are Whitfield's ointment and lotion, Castellani's paint, and a tinea paint consisting of the following :

Salicylic acid	..	5 per cent
Liquor picis carb.	..	25 per cent
Liquor iodi mitis ad.		100 per cent

It is said that the use of ointments is contra-indicated in the tropics, but there is no objection to the use of Whitfield's in infections which are not widespread. Even when briskly applied, however, it frequently is not strong enough.

There are other fungicides, of course. Of them the non-irritating ones such as the undecylenates and propionates are not potent enough to control infection. Phenyl mercuric salts are found to give rise too often both to direct irritant and to sensitivity reactions. For this reason they are not recommended for general use.

A paste, such as Lassar's, is useful in that more prolonged action is obtained. Emulsion bases tend to be washed away by rapid perspiration.

A fungus infection tends to be perpetuated by continued duties involving much perspiring. This must be borne in mind. Complete rest would probably cure without other treatment. Similarly, removal to a cool climate often cures dramatically. One must use one's clinical judgment in deciding how much

rest is required. A chronic indurated infection commonly lingers, for example, on the buttocks, and such cases do not improve without rest.

Foot Conditions.—First there are a few observations which must be made. It is important initially to have some clear concept of vesicular eruptions affecting the feet. An interdigital fungus infection may present as redness, scaling and maceration, or by typical rings of vesicles or broken vesicles. I am convinced that it is of greatest importance to realize that the vesicle, when it occurs on the hands or feet, is a non-specific reaction to various ætiological agents. The ring of vesicles in an interdigital tinea is a reaction to a ring of fungus infection. This may be treated with fungicides and cleared. But there may come a time when vesicles are produced as a reaction to overtreatment. If further fungicides are applied, the condition is merely aggravated. The vesicular eruption spreads, until finally one may finish up with widespread vesicle formation over the sole. Confluence of vesicles into bullæ, and desquamation, may lead to a sequence of events that makes the patient an invalid for months. I do not deny that the bullous dermatophytid does occur, but I am certain that serious vesicular and bullous eruptions are sometimes the sole result of overtreatment.

It is difficult to substantiate this concept. In Malaya foot fungus infections are so common that fungus may sometimes be cultured from conditions that are not primarily fungus infections. Again the technique of fungus culture is such that interdigital conditions on the feet which probably are primarily fungal do not yield positive cultures. Furthermore, fungus can occasionally be cultured from normal skin in reasonable proximity to a lesion.

Another common disorder of the tropics is plantar hyperidrosis. It may be sufficiently severe to necessitate invaliding to temperate conditions.

The proper handling of these foot conditions is important. If the foot is the medium of carriage of *Trichophyton* infections from U.K., then the sooner the infection is eradicated, the sooner will the tremendous loss of man-power occasioned by fungus infections be alleviated. The answer in prophylaxis, I am convinced, is not in the routine use of fungicides or paints, but as it always has been, in the rigid supervision of troops. It should not be left entirely to the Unit Medical Officer to examine men. Every officer should be capable of looking at the skin for obvious lesions, and examining toe-clefts for early signs. Next to this, a foot paint might be of value as a routine. Work is at present in progress to ascertain if the incidence of infection can be lowered by the routine use of foot paint.

A useful paint for application between the toes is the following :

Brilliant green ..	1.0
Hydrarg. perchlor.	0.1
70 per cent spirit	ad 100.0

It is easy to ensure that the paint has been applied. It does not cause desquamation and therefore does not lead to vesicular reactions. It is not a strong fungicide, and for frank infection something stronger may be required.

For vesicular eruptions, and in hyperidrosis, cold potassium permanganate foot soaks are useful. In this respect, it should not be left to an orderly to cast, haphazard, crystals into a bowl. Only too frequently the skin is blackened and burned by such a procedure. The accurate use of 1/8,000 solution is easily obtained by preparing a 1/200 solution, and making up $\frac{1}{2}$ ounce to the pint. The soak should be performed several times daily.

Hyperidrosis can usually be controlled by a careful routine of foot soaks, foot powder, frequent changes of sock, and finally careful application to the sole of 10 per cent formalin solution, when the initial maceration has subsided with rest and bland treatments.

Contact Dermatitis.—This is no less common in Malaya than elsewhere. I have two observations to make. First that a vesicular eruption of the fingers may be caused by oil ; secondly that sensitivity to green uniform is not uncommon.

The latter condition should be relatively easy to recognize. The majority of troops do not wear underpants, and the rash commonly commences on the thighs, buttocks, and around the waist-line. It is an erythemato-papular eruption which may stimulate to some extent miliaria rubra (prickly heat). Later the axillary folds become affected (but not the axillary apices), and finally the eruption becomes generalized. Removal from uniform causes subsidence of the eruption, which immediately recurs on return to contact. Such individuals have to be sent home.

Dermatitis Medicamentosa.—This is also common. One sees both the direct irritant effects and the general sensitivity reactions. Fungicides, for example, have to be used, but it should be constantly reiterated that in dermatological practice no harm, and often much good, is done by bland applications. Patients are admitted who have steadily deteriorated under a barrage of numerous applications of constantly increasing strength. All they need is rest and calamine lotion.

Fortunately local application of sulphonamides is prohibited in the Army in Malaya, so that the appalling complication of photosensitivity is not seen. I would point out, however, that the acridine compounds may cause their own reactions, including photosensitivity, and they may also be responsible for a flare-up of an old sulphonamide dermatitis.

Mercurial sensitivity also occurs, particularly in view of the use of mercurial medicated soaps.

Tropical Acne.—Some acnes improve, some deteriorate in the tropics. The man with a severe pustular acne should not be sent out, because this is the type that causes serious trouble. The milder cases can be handled in units if opportunity is given to them to work without shirts, and to tan. Ultraviolet light is absorbed to a great extent by perspiration and humidity, so that it is easy to burn, but less easy to tan. The usual general measures should be adopted, namely cleaning of the skin, daily removal of all blackheads, and application of a preparation such as sulphur and resorcin paste. There is evidence that staphylococcal toxoid may be of value in these cases. It should be given in once weekly subcutaneous injections of 1 c.c. (containing the

antigens of 1,500,000,000 organisms), over twelve to fifteen weeks. The more severely affected have to return home.

Miliaria Rubra (Prickly Heat).—I do not propose to discuss this in detail. O'Brien has made a recent and brilliant study of the condition. I will, however, briefly summarize the prophylaxis and the treatment recommended :

- (a) The wearing, as far as possible, of light airy clothing.
- (b) A sun-tan does seem to be of great benefit.
- (c) Sufficient baths to maintain cleanliness, but no more.
- (d) Use of the blandest possible soaps.
- (e) General use of dusting powders is probably detrimental.
- (f) In treatment, cautious twice-daily painting of 10 per cent lotio acid salicyl. to promote desquamation.

I am not convinced of the value of lanoline inunctions as recommended by O'Brien.

A word of warning is necessary : the final stage of tropical anhidrosis is attended with symptoms simulating anxiety or hysteria. At this stage patients are not far from heat-stroke, and may be febrile.

Bullous Impetigo.—This is quite common in the tropics. It is a staphylococcal infection of mild nature which settles in sites most prone to perspiration, such as the axillæ and the crutch. Any mild antiseptic is usually effective. I recommend 1/1,000 gentian violet or 1/1,000 hydrarg. perchlor. Patients should keep cool as far as possible.

Scabies.—I would just emphasize that a septic scabies cannot be expected to settle until the treatment for scabies has been given. The scabies must be treated first, and then the sepsis.

Chronic Urticaria.—Helminth infections must be considered, and the stools searched for ova.

Tropical Ulcer.—K.L.B. may be the cause. The organism is difficult to isolate. Toxæmia and paralysis are rare, but have occurred. Many ulcers show Vincent's organisms, and respond to parenteral penicillin.

Pityriasis Versicolor.—The depigmented patches common in Malays are due to this. Examination of scales in 10 per cent liquor potassæ reveals typical short hyphæ and " bunch of grape " spores. It does occur in Europeans, in which case the apparent colour depends on the degree of tan of the individual. Any fungicide is effective in treatment ; so also is 2 per cent sulphur, 2 per cent acid salicyl. in an emulsion base, or in vaseline.

I wish to thank Brig. T. Young, *O.B.E.*, D.M.S., Farelf, and Colonel C. P. Chambers, O.C. Military Hospital, Singapore, for permission to forward this article for publication.

REFERENCE

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A HUNDRED YEARS OF INSECTICIDES AND REPELLENTS IN THE ARMY (A Historical Summary)

BY

A. F. H. KEATINGE, M.C., M.B.
Royal Army Medical Corps

“ We have discovered many preventives against tropical diseases, and against the onslaught of insects of all kinds from lice to mosquitoes and back again.”

The Rt. Hon. Winston Spencer Churchill, O.M.
(Broadcast speech, September 28, 1944)

GENERAL INTRODUCTION

In a search for material to use as an introduction to a comprehensive paper on insecticides I have delved through many early Army records and histories.

The story which unfolded, and the wealth of information which accrued from my studies, fascinated me to such an extent that I abandoned the idea of my original dissertation and substituted the title which this paper now bears.

In limiting myself to a historical summary in place of the extensive survey previously designed, I was influenced by the following facts :

- (1) The summary provides an interesting cross-section of the evolution of tropical medicine from the viewpoint of preventive medicine.
- (2) The gradually increasing use of insecticides and repellents has had a profound effect on the health of the Army.
- (3) The employment of insecticides, repellents, and general hygienic principles have, possibly, done more to reduce the incidence of sickness amongst Service personnel than any other department of medical science.
- (4) The clear thinking of our forebears, their readiness to accept new facts of medical science, and their promptitude in utilizing these facts to the benefit of the Army must always remain an inspiration to a younger generation of medical officers.

INTRODUCTION

The oldest available record of an insecticide is Homer's mention (about 1000 B.C.) of the “ pest averting sulphur ” and the “ divine and purifying fumigation.”

Cato, about 200 B.C., is said to have advised the use of a mixture of bitumen and sulphur, boiled where the fumes could blow through the trees to kill the “ vine fretter.” There are records as early as A.D. 900 of the use by the Chinese of powdered arsenic sulphides mixed with wine to control insects on garden plants.

In 1596 a famous Chinese pharmacologist, Lee, quoted a number of records concerning the use of poisonous plants for controlling insects such as bedbugs, fleas, mosquitoes and moths [1].

In 1767 James Lind, physician to Haslar Hospital, who re-discovered the cure for scurvy, wrote an "Essay on Diseases to Europeans in Hot Climates with the Method of Preventing Their Fatal Consequences" [2], in which, though mistakenly attributing the cause of "intermittent fever" in Bengal to the foggy night air and swamp miasma, he notes the presence of mosquitoes and suggests: "The best preventive against the mischievous impressions of a putrid fog, or of a marshy exhalation, is a close, sheltered and covered place; such as . . . a house in which there are no doors or windows facing the swamps. If, in such a place, a fire be kept, either in the chambers or at the doors . . . it will prove an excellent and effective protection against the injuries of a bad air."

Later on in the essay he deplores the excessive casualties from "intermittent fever," suffered by soldiers when cutting down trees, especially in swamps and he suggests that: "In the evenings, before sun-set, they should bare off work and not return to their labour in the morning till the sun has dispersed the unwholesome dews and vapours. For their safety during the night they should retire to a closed hut . . . where the apartment in which they lie should be well fumigated with gun-powder, as fire and smoke will afford them the most excellent defence against the noxious and dangerous qualities of the night air. The smoking of tobacco in their huts and chewing of garlic are circumstances which will also contribute to their preservation."

There is little doubt but that the measures advised by James Lind, if carried out, must have acted as a very effective mosquito repellent.

1848-1913

Derris and pyrethrum were the best insecticides known until D.D.T. came into general use during the last war, and they are, even now, amongst the quickest in action.

Derris was first mentioned as an insecticide in 1848 by Oxley who used it for the control of nutmeg insects. In "The Arabian Nights" we read that pyrethrum flowers were used by the Arabs for killing insects and worms, but the first published reference to the nature of pyrethrum was in 1851 when it was stated that the flowers of "pyrethrum roseum" yield the Persian insect powder.

Hydrocyanic acid was known to the Egyptians as a poison derived from extracts of the peach, but the earliest record of its use as an insecticide fumigant was in 1877, when it was used to kill museum pests in insect collections.

The pages of the Army Medical Department Report—which later becomes the Report on the Health of the Army—yield a fascinating study of the evolution of insecticides and repellents in the Army.

This document is published annually but it ceased publication during the 1914-18 War and the last War.

Dr. E. A. Parkes, M.D., F.R.S., first Professor of Military Hygiene, in the

Army Medical School, in his report on Hygiene for the year 1865, quotes a report on disinfection by Dr. Angus Smith and Mr. Crooks in the Third Report of the Cattle Plague Commissioners. Speaking of the properties of the Tar Acids they say : " It appears that carbolic acid acts by attacking vitality in some mysterious way. . . . Caterpillars, beetles, crickets, fleas, moths and gnats were covered with a glass, the inside of which was smeared with carbolic acid. The vapour proved quickly fatal. . . . I find it recorded by Dr. Lemaire, and others, that carbolic acid vapour will also kill flies, ants and their eggs, lice, bugs, ticks, acari, mosquitoes, aphids, butterflies, earwigs, wood-lice, cock-chafers, centipedes and other insects of this size ; its vapour, however, does not appear to be strong enough to act injuriously on animals larger than mice. . . . From the intense aversion shown by all insects to the odour of carbolic acid it is probable that the plentiful use of this agent would effectually preserve cattle from those terrible scourges met with in certain parts of Africa, the zimb and tse-tse fly.

" Carbolic acid also prevents the development of malaria, but it is impossible, of course, to use it on such a scale as to produce much action in this direction " [3].

Dr. Parkes in his report on Hygiene for 1871 (his last report before he died in 1875), quotes Dr. S. Meredith, in his considerations of the causes of malarious diseases in the *Indian Medical Gazette* for 1871, as saying " The Charcoal burners of different tea-gardens in Assam, who live near the pits and the charcoal and who breathe an air strongly impregnated with the smoke and other products from the burning, rarely suffered from malarious complaints. . . . The second case of immunity from malaria was in the labourers employed at the petroleum oil-springs at Marhum, above Jeypore, in Upper Assam. The smell of petroleum is everywhere perceptible. Fifty-nine men, women and children, employed there for two years had only one death—an old woman. There was no anæmia, and cases of malarious fever were only occasional, and were never protracted. Leeches, frogs, centipedes, lizards, mosquitoes and sandflies rarely came within the smell of the petroleum " [4].

The Medical Department of the War Office issued a memorandum in 1885 for the information of the medical staff of the Suakin Expeditionary Force. They note as follows :

" . . . Wounds may be protected against flies by the local use of infusion of Quassia, weak solution of Cresote, or by the application of a piece of lint steeped in Turpentine and Camphor outside the dressing. There will be supplies of fans and mosquito netting provided " [5].

Surgeon-Colonel J. Lane Notter, Professor of Military Hygiene at the Army Medical School at Netley, notes a fact of outstanding importance in his report on the progress of hygiene for the year 1897 : " Malarial Infection—Laveran rejects aerial communication as improbable, and water as a possible, but unproven vehicle. He is inclined to look on the bites of mosquitoes, etc., as the chief means of infection, as they certainly are in filaria, Texas fever, etc. All the usual precautions, as drying of the soil, avoidance of night air, and of

sleeping on the ground, mosquito curtains indoors and smoky fires in camps, seem unconsciously directed against such insects" [6].

Major W. H. Horrocks, R.A.M.C., Assistant Professor Military Hygiene reporting on recent literature, in his notes on the Progress of Hygiene for the year 1900, mentions a pamphlet issued by the Liverpool School of Tropical Medicine giving "Instructions for the Prevention of Malarial Fevers," he says :

"This pamphlet has been issued for the instruction of residents in malarious places. Prevention is based entirely on the 'mosquito theory.' To prevent malarial infection measures to avoid being bitten by mosquitoes must be taken, and *Anopheles* must be destroyed. Mosquito nets are to be used, large collections of water are to be filled in or drained, or if this cannot be done, oil is to be applied to the surface of the water."

Major Horrocks then speaks of his attendance at the Congress of the Royal Institute of Public Health in Aberdeen, under the Presidency of the Earl of Aberdeen—"Dr. Manson read a paper on 'Malaria, A Sanitary Problem.' After describing the mosquito theory he stated that the present knowledge of the habits of *Anopheles* should enable us to prevent malaria. He regarded the duties of sanitarians as a body in relation to malaria to be as follows : (1) Instruction of the interested public on the mosquito-malaria theory and its application. (2) Insistence on adequate education in our medical teaching institutions in malariology. (3) The urging of these methods on governments, municipalities, naval and military authorities, industrial companies and others interested in the tropics" [7].

Major R. A. Firth, R.A.M.C., who was Professor of Military Hygiene in 1901, writing on the aetiology of yellow fever says :

"The endeavour to prove a man-to-man transference of Yellow Fever by means of gnats or mosquitoes has received much attention from a recent American Commission to Cuba. Some of their experiments included the biting of certain non-immune persons by mosquitoes (*Culex fasciatus*) which had fed on severe cases of Yellow Fever. Of seven non-immunes bitten by contaminated mosquitoes six contracted the disease. . . . It would seem, therefore, that Yellow Fever like malaria, may be conveyed . . . by the bite of a particular mosquito" [8].

And the next year he writes : "In the last year's report I called attention to the remarkable work being done in Cuba by the Americans as to the transmission of Yellow Fever.

"Since then the main facts and principles of their work having been made known, it may be said that one of the most brilliant medical discoveries of the age has been made in Havana during the last two years.

"Then somewhat heroic experimental investigations of the Americans have shown . . . that like malaria it is conveyed from man to man by mosquitoes. Only one known species of mosquito was found to have the power of transmitting the germ of yellow fever ; this is the *Stegomyia fasciata* . . . Once accepting this conception of the aetiology and dissemination of yellow fever, we are in a position to formulate means for its prevention. These naturally resolve themselves into : (1) Means to prevent the *Stegomyia* from becoming infected.

- (2) Destruction of all possibly infected mosquitoes in the sick room ; and
- (3) Extermination of all mosquitoes in the general vicinity " [9].

Major Firth then goes on to speak at some length of fumigation of the infected louse and an "organized crusade" against the whole race of mosquitoes, destruction of breeding places, etc.

In the Army Medical Report for the year 1904 a note on the health of the European troops serving in India says : " The opinion that the infection of enteric fever, and possibly of other diseases, is not infrequently carried out by flies, is so generally held and the epidemiology and bacteriological evidence in support of it is so strong, that systematic efforts to reduce the numbers of these pests in cantonments seems urgently called for " [10].

Later on in the same report a certain station is described where flies were very numerous and where every effort was made to keep the cookhouses free of them sulphur fumigation being occasionally resorted to for that purpose.

Lieutenant Colonel C. W. S. Magrath, R.A.M.C., writing in the *British Medical Journal* in 1906, says : " I wish to mention a precaution against malarial fever which, during four years' civil work in Upper Burma, I, personally, found of the greatest value.

" I allude to the inunction of the exposed parts of the body with aromatic oils, which prevent, or at least discourage, the attacks of mosquitoes. My work took me at all seasons of the year into jungles which were simply poisonous with malaria, and all the leave I could obtain was spent in pursuit of big game, which invariably frequents the most malarious localities ; and, although by no means immune naturally, the only attack I got was once when, having forgotten my oil, I was out for two nights. On one occasion, out of a party of eleven, although all had mosquito curtains, two who used the oil alone escaped fever and I could multiply instances of its value *ad infinitum* " [11].

The Army Medical Report for 1908 mentions that in the preventive measures against malaria in India larvicidal measures had been carried out without any great reductions in the mosquito population, and that fumigation of the barrack rooms with sulphurous acid had been tried at Peshawar and Ambala [12].

The presence of bugs in the barrack rooms of the forces in Egypt was a source of much complaint. In 1909 the report says : " The barracks at Kas-el-Nil, the Citadel and the Polygon were treated with Clayton gas in an attempt to get rid of the bugs. Though enormous numbers of these insects were killed, and eggs in bedding and places freely exposed to the action of the gas, were sterilized, there is no doubt that little or no effect was produced on the inhabitants of the holes and burrows in the walls."

In the same year, the report on the health of the troops serving in the South African Command commenting on the prevention of malaria says : " Early in April Mosquito Brigades were formed who drained the pools if reasonably feasible and paraffined the water in all other instances. The result was an almost immediate cessation of the disease."

In India the fight against the mosquito was also being waged, but without the encouraging results found in South Africa. The report from India states : " Among other preventive measures may be mentioned fumigation of barracks

and the use of mosquito nets. Fumigation has been found to be a failure, or rather the diminution of mosquitoes in barracks has not been commensurate with the trouble and expense." The battle against the fly was being more successful. "Perhaps one of the greatest influences on our control of Enteric Fever is the steady improvement apparent in the general sanitary condition of barracks and cantonments. The abolition or rather the definite reduction, of flies in and about the lines is a most encouraging feature. This is largely due to the introduction of a wet system of conservancy in place of the old and objectionable dry-earth method. This is now universal, the reagent used being a solution of saponified cresol. Very striking results have been obtained at Cawnpore where Lt.-Col. W. A. Morris has tried the employment of bichloride of mercury in place of cresol. The solution used is of a strength of 1 in 2,000. It is probably immaterial what reagent we are using in the latrine pans, provided it is sufficiently antiseptic and effectually a deterrent of flies" [15].

In the year 1910 the *Phlebotomus papatarii* had been implicated as the vector of sandfly fever. Spraying with formaldehyde solution was found useful in keeping down the pests [14].

The Manual of Military Hygiene of the American Army in 1914 gave an interesting list of the insecticides in use at that time [15].

They were as follows :

Pyrethrum—Insect powder.

Datura stramonium—Powdered common Jimson Weed.

Mimms culicide (campho-phenol)—made of equal parts of carbolic acid crystals and gum camphor.

Pyrofume—Derived from pine wood by fractional distillation.

Sulphur dioxide—Probably the best-known insecticide.

Hydrocyanic acid gas—.

Formaldehyde—.

Mercuric chloride—.

THE 1914-1918 WAR

During the 1914-18 War many advances took place in the use of insecticides and repellents, but little was published at the time. The medical history of the war gives a deal of information which is summarized below [16] :

Prevention or Malaria.—Preventive measures : Active measures of immediate malaria prevention were elaborated in greater or less perfection on the different Army fronts. These measures may be classified as :

- (1) Drug prophylaxis and treatment.
- (2) Culicifuges or mosquito deterrents.
- (3) Personal protection.
- (4) Mosquito destruction.

Culicifuges or Mosquito Deterrents.—The application to the skin of substances believed to repel mosquitoes had been a measure in use from time immemorial. Popular confidence had been placed mainly in essential oil.

During the war fairly extensive laboratory investigations were conducted with a view to determining the repellent power of different substances.

The results were unsatisfactory . . . the general conclusion was that it had

not been demonstrated that "culicifuge" preparations had any value as an anti-malaria measure of such certainty as to warrant the expense of their being supplied to troops.

Mosquito Destruction.—When energetically and wisely pursued, constantly gave immediate and obvious results.

The mosquito was attacked directly and in all stages of its existence—ova, larvæ, pupæ and imagines; and indirectly its continuity was threatened by the removal of its breeding places.

The methods of attack on ova, larvæ and pupæ were various. Chemical treatment of waters was employed by the use of many chemical disinfectants. Cresol in certain dilutions was found an effective larvicide, and was frequently used because it was perhaps the most convenient disinfectant available. Oiling of waters was extensively employed with the proved oils and emulsions. The principle, however, which had long been established in the destruction of the embryonic mosquito and which was the main element of mosquito reduction during the war, was the conversion of real and potential breeding places into impossible or unlikely breeding places . . . an aid to the treatment of water channels was the stocking of waters with "natural enemies," the most reliable of which are fish.

Prevention of Flies.—The subject of flies in their relation to the spread of disease was one which had assumed considerable prominence before the war. and the necessity of adopting rigid anti-fly measures to protect troops in the various theatres of war received early recognition from the responsible medical authorities. In the East, indeed, the fly problem soon came to be regarded as one of the most important sanitary problems to be solved. Much anxious thought and energy were devoted by sanitary officers to investigations in the habits of flies and into the methods of destruction of both the mature and immature insect.

As a result of this work new knowledge was acquired and greatly improved methods of fly control were derived.

The Director-General Army Medical Services appointed a committee in April 1915 to investigate and report on the best methods to employ for the prevention of flies. . . . In the meantime a circular memorandum was issued by the Director-General of Army Medical Services in France, entitled "The Abolition of Flies in Camps, Billets and Hospitals."

Various methods were recommended for the destruction of the adult fly, such as "ballon" fly traps, papers, wires, tapes, strings and other material covered with a sticky substance made by beating together resin and castor-oil. leather fly-flaps and the spraying interiors of kitchens and mess-rooms with cresol emulsion.

Two poisons were also described; formalin (1 in 80) with the addition of a little sugar or honey for indoor use, and for outdoor use sodium arsenite, a solution of which was to be sprayed over such places as manure heaps and the surrounding vegetation; or leafy branches were to be dipped in the solution and hung over latrines and other places which attracted flies. Sprays and fumes although ineffective in the open, were found useful in killing flies in

tents, huts and buildings and they were used to the greatest advantage in the evening after the flies had settled down for the night.

The fluids most commonly employed were cresol (1 in 360) and Lefroy's fluid (1 in 40). The latter consists of pyrethrum powder, methylated spirit, saffrol and aniline. 10 c.c. of the undiluted solution is sufficient to spray 1,000 cubic feet. The solution was somewhat expensive and in practice it was found that flies were not killed unless the fluid came into actual contact with them.

The cresol spray was found equally effective and cheaper and was always available.

In Macedonia a paraffin emulsion was tried and found to be effective. It was made of one gallon of paraffin with a quarter of a pound of soap and half a gallon of water. The undiluted emulsion proved fatal to flies almost instantly. Keating's powder (pyrethrum) burnt on a tin lid over a flame in a confined area, was poisonous to flies.

Prevention of Sandflies.—Protection against sandflies under field conditions was almost impossible, and in badly infected areas 50 per cent of the troops might develop the fever within a few weeks. Where the flies were numerous, large numbers could be killed by fumigating rooms and dugouts with sulphur or spraying with formalin or cresol.

Certain repellent ointments were useful, "Vermijelli" proving one of the best, and various essential oils, especially oil of cassia, were effective as long as the scent lasted. In the absence of anything better paraffin would secure a few hours immunity from annoyance.

Prevention of Infestation by Lice.—At the outbreak of the war there was comparatively little exact knowledge as to the efficacy of insecticides (against lice). Preparations by the hundred were sent to the War Office, but beyond the statement of the makers there was little evidence produced to guide the authorities in the selection of the most suitable remedies.

In 1914 experiments were made at the Royal Army Medical College on the lethal and repellent actions of various preparations; eventually a powder, composed of naphthalene 96 parts, creosote 2 parts and iodoform 2 parts, was devised for use and was generally known as N.C.I. Powder.

A leaflet on the prevention of lice was issued by the War Office in 1915. N.C.I. Powder was recommended to be dusted on the underclothing, and Vermijelli to be rubbed into the seams.

Lieutenant Peacock tested many insecticides under field conditions and found the N.C.I. Powder to be the best all-round insecticide.

Mr. Bacot, the entomologist to the Lister Institute, carried out for the War Office a large number of experiments on insecticides and did not obtain good results with the "Vermijelli" and recommended the use of a paste made with crude, drained, unwhizzed naphthalene from modern coke ovens, that obtained from gas plants being far less efficient. It formed an excellent efficient insecticide and could be used for smearing between seams in tunics or breeches. A single application was considered effective for about one week.

1919-1938

After the war was over there was very little published in Army records about insecticides until 1922, when the first mention of Bamber oil was made: "Bamber oil is the formula most commonly used (as a mosquito repellent) for sentries, guards or men on other duties which prohibit the use of nets, this oil is of great value. It must be realized, however, that its effects only last for three or four hours and that it must be liberally applied. A half an ounce for each man is the smallest quantity that will efficiently protect him whilst on guard duty [17].

Paraffin citronella oil was used in India in 1923 as a repellent: "Some measure of protection is obtained by the use of repellents and P.C. oil is provided and ordered to be used, especially by men on guard and other duties at night" [18].

In 1926 the report on anti-mosquito measures in India mentioned the use of Paris Green as a larvicide: "Anti-mosquito measures with a view to eradicating mosquito breeding places by draining off the water or by killing the larvæ with oil, Paris Green, etc., and also to the destruction of adult mosquitoes by fumigation, trapping and swatting, are carried out in all malarious stations" [19].

"Paris Green has been used extensively in certain areas with success and without any ill-effect on the personnel employed or on animals drinking the treated water. This larvicide is considerably cheaper than oil and its use is being extended" [20].

In the year 1929 investigations were carried out at various stations in India into the value of the Army Fly spray. This consisted of:—

" Pulvis pyrethrum	117 lb.
Spiritus rectificatus	912 lb.
Camphor oil ..	780 lb.
Sapo durus pulvis ..	2 lb. 6 oz.

"The results briefly are:

"(1) Army fly spray diluted to 1 in 15 as directed is of little use as an insecticide or repellent.

"(2) Used in full strength in the open it has no action beyond that of a repellent and even its repellent action lasts under half an hour.

"(3) Army fly spray is inflammable and stains fabrics.

"(4) A mixture evolved by Mansell in Peshawar consisting of:

Carbon tetrachloride (medicinally pure)	1 per cent
Synthetic oil of Wintergreen	2 per cent
Kerosene oil, second quality	97 per cent

was tested against mosquitoes only and found to be at least as effective as 'Flit.' Further trials are being carried out with the mixture" [21].

In China during 1930, the anti-malarial measures were having some success in the Hong Kong area but in Shanghai it was quite a different story: "The ratio (of admissions to Hospital with malaria) in the Hong Kong area was 35.7 per 1,000 compared with 99.0 in 1929 and 120.0 in 1928.

"This reduction is attributed to the success of the drainage carried out in the swampy areas close to the barracks at Lyemun and the modern oiling methods employed. . . . The oiling was done with 'anti-malarial' mixture consisting of Diesel oil, solar oil and kerosene distributed by 'Four Oak' Sprayers and was considered highly satisfactory. In the Shanghai area the incidence (of malaria) increased to 77.2 per 1,000. Little anti-malaria work by the military authorities is possible in this area. The municipal authorities, whose actions are restricted by fear of political complications, have made certain essays at anti-malaria work by oiling, the use of Paris Green and by the introduction of predatory fish, but the oiling was objected to on account of the smell, the Paris Green on account of its lethal action on the local ducks while the predatory fish, though in no way objected to, only acted as an 'extra' to the dietary of both Chinese and ducks" [22].

In India during the same year: "An 'oil bomb' consisting of empty tins perforated with holes and filled with oily rags, was devised. These tins were thrown into the ponds, etc., and were found to oil the water satisfactorily.

"A novel method of oiling ponds where opposition had been encountered was devised by one Warrant Officer in Charge of an anti-malaria work. His method was that of oiling the local buffaloes during the night, so that during the day they acted in a similar manner to the oil bombs described above, although on a larger scale.

"Fairly extensive spraying experiments were carried out during the year with the mixture evolved in Peshawar in 1929 (see p. 298 for composition) to every gallon of which was added a quarter of a pound of naphthalene balls.

"The results were somewhat conflicting, but generally indicated that the spray has a definite lethal effect, particularly on anopheline mosquitoes, but that a proportion are temporarily immobilized and not killed. In small rooms it was effective in clearing the room of mosquitoes but in large rooms the results were not commensurate with the expense incurred. The deterrent effect lasted twenty-four hours" [22].

"The usual anti-fly measures in Egypt (in 1931) were augmented by the issue of mechanical sprays and a solution of fresh pyrethrum powder, paraffin oil and oil of wintergreen, made up by the R.A.S.C., and called by them 'Flysol.' In addition to very satisfactory results against flies, this has been found to be a most satisfactory sandfly deterrent when used on barrack room floors and walls. The price of this solution is about one-fifth that of corresponding efficient proprietary preparations" [23].

In 1932 the extent of the infestation of barrack rooms with bed-bugs was brought to general notice, and every effort made to rid the soldier of this source of irritation. "In Egypt, Gibraltar and Malta the soldier still suffers from bugs in various barrack rooms.

"In Gibraltar the introduction of ants nests is still regarded as a success (in 1931 the experiment of introducing ants into bug-infested localities, to prey on the bugs and their eggs, was tried with a certain amount of success) but the nests are difficult to obtain.

"In none of these places is there any evidence that bugs have originated

any special disease . . . but they are a source of great irritation, particularly to newly arrived young soldiers " [24].

" Both at home and abroad efforts to rid infested barracks and quarters of the bug pests have continued (in 1933). The standard formalin and bleach method has been unfavourably reported on, but this may be due to failure or inability to carry out the procedure correctly. Certain spray preparations which were tried have the advantage of being easy to use, as the effect is to drive the bugs out of their hiding places into the open where they can easily be seen and destroyed. It would appear that fumigation with hydrocyanic acid gas must still be considered the most reliable method. . . . In Egypt, as a result of a successful demonstration by a firm using hydrocyanic acid gas, authority has been given for the disinfection of an entire barrack block " [25].

In 1934 this barrack block was disinfested by a civilian firm of experts and the result proved to be extremely satisfactory, all bugs and their eggs being destroyed . . . " Following on these successful results . . . an experiment with other methods was carried out at the Citadel, Cairo. By treatment with sulphur dioxide and in another experiment with formaldehyde, success was not obtained, and the conclusion was arrived at that the disinfection of barracks, at any rate in Egypt, necessitates the employment of professionals."

In the Hygiene Department of the Royal Army Medical College " extended trials were made into the value of liquid sulphur dioxide sprayed by men working in gas-masks. The method failed in certain heavily infested quarters, though it had previously proved successful when tried in other quarters in which infestation was not so severe " [26]. In 1935 " a proprietary insecticide of the sulphur type was used extensively throughout the year. It was found effective and easy to apply as it is not necessary to remove the skirting or floor boards before disinfecting a room. The blocks of sulphur are a standard size sufficient to treat 1,000 cubic feet and the rooms receive two treatments at fourteen-day intervals.

" In Gibraltar where the bug is in permanent residence, two methods were devised to reduce their number. A trial was first made of a spray consisting of one-third cresol and two-thirds formalin, both of which are normally obtainable from Army sources. Continuous use of the solution had a very salutary effect although complete eradication by this method could not be expected. It had, however, the disadvantage of staining whitewashed walls. Later a mixture of sulphur and formalin was used very effectively not only against bugs but also against cockroaches. The resultant powder was packed into tins and set alight with the help of methylated spirit.

" The Central Bakery at Aldershot had resisted prolonged use of borax and sugar mixture and various insecticide sprays. A trial was made of a mixture of sodium fluoride and flour in equal proportions and the results were so satisfactory that a co-ordinated campaign was also conducted throughout thirty married quarters. Repeated courses of ten days' duration, with an interval of four days between the courses, resulted in the complete eradication of the

insects in twelve weeks at a cost of one shilling and eight pence per married quarter" [27].

In 1936 trials were made in India "to find a culicifuge with a less fleeting action than paraffin citronella oil and one which can more easily be carried by the troops.

"A semi-solid substance known as Dover's cream, consisting of oil of citronella $\frac{1}{2}$ oz. and

Spirits of camphor ..	$\frac{1}{4}$ oz.
Oil of cedar wood ..	$\frac{1}{4}$ oz.
White petroleum jelly	2 oz.

"This cream gave a promise of good results and is to be issued in screw-cap aluminium containers" [28].

In 1937 reports on Dover's cream: "are unanimous that the cream is a great advance on any previous culicifuge preparation; not only was it effective against mosquitoes but also against sandflies. Steps have been taken to have P.C. Oil replaced, as an authorized issue, on an 'as required' basis, by the cream, and the aluminium containers will be a general issue to troops on a 25 per cent basis for use of sentries, roving parties, and patrols and troops during training periods, when nets are not in use.

"Hydrocyanic acid gas has not proved entirely satisfactory in eradicating bugs from Egyptian barracks, as it has been found that within the year infestation is as bad as ever. The action of the insecticide fumigant, Cimex, has been sufficiently satisfactory to justify a continuation of its use. Cimex is also being used in Gibraltar and has proved most satisfactory" [29].

Hygiene reports were not issued for 1938 and in 1939 came the war and great discoveries in the eternal fight against the insect. The wonderful new weapons which were forged in this period are described in the next section.

THE 1939-1945 WAR

Naples

This is a brief résumé of the rise and fall of a typhus epidemic in the city of Naples during the winter of 1943-44, and the part played in its termination by the use of insecticides on a large scale.

Most of the information given here has been abstracted from reports by Colonel H. D. Chalke, late R.A.M.C., who was the Senior Hygiene Officer of the Allied Armies in Italy.

It is a lesson which teaches that an epidemic of typhus fever occurring in a city where the conditions are most favourable for its spread during the winter months, can be completely spotted and utterly overwhelmed by the energetic and widespread use of efficient insecticides.

James Lind, writing in 1767 of an epidemic which occurred in 1764, says of Naples: "The situation is remarkably healthy, it is very populous, the streets are numerous, the houses are five or six stories high, and very much crowded. The inhabitants are extremely remiss in the article of cleanliness, both within and without their habitation" [2]. When Naples was occupied in October 1943, the Fifth Army found that it hadn't changed so very much in 180 years.

It is true that many of the five or six storied houses had been knocked down by Allied bombs and the crowds were found to a large extent in the caves and tunnels below the numerous streets—20,000 to 30,000 people living permanently in these Air Raid Shelters. It is also doubtful if the situation of Naples could have been considered as being really remarkably healthy, it had certainly been pretty badly bombed by the Allies and later by the Germans. But there was no doubt about the numbers of the population, or of the streets, or of the remissness of the inhabitants in the article of cleanliness.

Colonel Chalke notes that it was “a very sad city, badly bombed, overcrowded, with a depressed and undernourished population living in considerable numbers permanently in shelters. Naples seemed to be the perfect stage setting for a large-scale epidemic. Means of heating and lighting were lacking, the water mains and sewers were ruptured and a large proportion of the population were lousy” [30].

On November 20 the first 7 cases of typhus were reported in the city and another 29 occurred that month.

December saw the numbers increase from 22 fresh cases in the first week to 138 during the last week. It was obvious that a severe epidemic of typhus was going to occur in Naples. Schemes and plans were quickly made up and wholesale insecticide dusting of troops, civilians employed by the Army, and civilians was instituted.

Cases continued to increase up to a daily total of 65 by the end of the first week in January and then there was a dramatic drop from 340 per week to 170 per week.

This level was maintained till the end of January when there was another steep fall to 40 a week and from then on the epidemic gradually petered out. Cases continued to occur outside the city until the end of March but by that time the danger was over. 1,600 cases occurred in all.

The methods employed to deal with the epidemic were “case searching, contact delousing, and block dusting” which were started early in December.

“The American Army insecticide (M.Y.L.) powder containing pyroturum was used, being applied mechanically by means of dust-guns. Every available contact in the family and outside, together with everyone in the building or block of buildings, was dealt with. Adjusting centre was opened in a room in the house to which persons living in the neighbourhood could come. Up to 200 persons per case were dusted in this manner.

“This method of application of insecticide powder (MYL AL63 or DDT) by means of dust-guns has advantages over the old-fashioned method of hand-dusting of the underclothes. It can be done without removal of the clothes and large numbers of people can be dealt with quickly and efficiently.

“The powder is forced down the sleeves so that it reaches the axillæ, down the front and back of the neck inside the shirt, and inside the trousers to the pubic region. The hair (and inside of the hat) is also dusted” [31].

By the end of December all the inhabitants of the caves and other air-raid shelters were being dusted every ten days. British Hygiene Sections were

responsible for controlling the dusting of the 30,000 Italian civilians employed by the Army, the Italian Army, refugees and the British Troops.

All these people were dusted at fortnightly intervals with the British being done at weekly intervals.

Anti-louse powder 63—which at this time did not contain DDT was used until early in January when DDT powder was made available in large quantities and, in a 10 per cent mixture in talc, it was then used exclusively. Up to this time it was only used in about 10 per cent of the cases.

From January 1 all mass and contact civilians dusting was done with DDT under the organization of Brigadier-General Fox, U.S.A. Medical Corps, up to a maximum of 70,000 dustings daily. By the end of February 2,250,000 people had been dusted. This figure does not include the civilians employed by the Army who were being dealt with by the British Hygiene Sections.

Other methods employed in the control of the epidemic were the use of Cox's vaccine in immunizing British Troops, the use of the vaccine of Durand and Giroud to immunize a selected number of Italians employed by the Army, the closure of cinemas and public places of amusement, and the reopening of schools, as children could be easily dusted at school and could be taught about the prevention of the disease. Troops were forbidden entry to certain parts of the town and were not allowed to travel on public vehicles or go to restaurants and eventually Naples was placed out of bounds to Allied Forces except those on essential duty.

The dramatic fall in the number of new cases round about January 9 has already been referred to. This was obviously the moment when apparently disaster was overcome and was the beginning of the end of the epidemic.

The incubation period of typhus is twelve days, and, as few cases were notified before the fourth or fifth day, the factors which were responsible for the fall must have been operating some sixteen or seventeen days before January 9, i.e. December 24 or 25. Up to this date the Americans' Army pyrethrum-containing insecticide was the main powder being used for dusting civilians, therefore there can be little doubt that to this insecticide must go the chief credit for the initial defeat of the outbreak. "DDT was brought into use on a large scale early in January and mass civilian dusting was intensified. An enormous decrease in the louse population followed. Thus the epidemic, already defeated, was given its *coup de grâce*, and all risks of a flare up were prevented" [31].

One cannot detract from the credit due to the insecticides, and the vigour with which they were applied by suggesting that inoculation, improvement in dietary, or relief overcrowding were responsible for the ending of the epidemic.

In December the number of civilians who were protected by inoculation was negligible and by April only 60,000 out of more than 1,000,000 were protected. The inoculation state of the British Army was pretty low in December, though it was brought up gradually as vaccine became available. The economics situation was appalling and did not improve for some time after the epidemic was over and there were marked deficiencies in the dietary.

The number of people living permanently in the caves and air-raid shelters

was not reduced to any extent during the months of January and the overcrowding was rampant. It would seem that any efficient insecticide powder used in the manner described will be successful in combating infestation and the disease which goes with it.

DDT does not kill lice quickly, but it is non-irritant and persistent, having a residual action, which prevents reinfestation. It is particularly valuable where people are not under strict discipline, and where washing and laundry arrangements are defective [31]. No ill-effects were noted during the treatment of more than a million civilians with 10 per cent DDT, nor were the operators who were always white with dust, adversely affected [30].

Germany and Belsen

Before the invasion of Germany by the Allied Armies information had been obtained that typhus was more or less widely seeded throughout the country [32].

It was essential, therefore, that a plan should be made which would ensure the disinfection of the great numbers of displaced persons, who could be expected to try to regain their homes in the West as the Allied Armies advanced into Germany. Colonel T. F. Kennedy, late R.A.M.C., who was the Director of Public Health (Civil Affairs) 21 Army Group and later the Principal Medical Officer of the I.A.2C Division of the Control Commission, states with regard to this plan : "It was decided that the main waterways traversing the country from North to South, in which the majority of the bridges would undoubtedly be destroyed, would form the best barriers. Control disinfection centres were therefore set up at the following lines in succession : Rhine—Ijssel. Dortmund Ems Canal, River Wesel and River Elbe.

"The disinfection centres were supplied with hand and power powder-guns and 10 per cent DDT powder was liberally dusted on all civilians presenting themselves at the crossings of the waterways" [32].

The results obtained were amazingly good and few escaped being dusted. Dr. Pirrie tells of one embittered deportee, who assured him he had only to rest on the roadside for five minutes and someone would appear and smother him in DDT and offer him a cup of tea.

"A certain number of typhus infected persons filtered through these barriers in the incubation period and developed the disease at their destination. The passage of these cases was unavoidable short of instituting quarantine stations which was quite impracticable.

"Of about one and a half million displaced persons who were evacuated Westwards in the first few months, the number of secondary infections arising as a result in Western Europe, was surprisingly small.

"We had put our faith in DDT and it certainly proved to be a most effective weapon in the control of typhus. One recalls the devastating epidemics of typhus fever during and after the 1914-18 war and one shudders to think what might have happened in Western Europe had we not had DDT at our disposal" [32].

On April 10, 1945, Belsen Camp, the worst of all the concentration camps,

was liberated by the advancing British Second Army. Brigadier H. L. Glyn-Hughes, late R.A.M.C., visited Belsen within twenty-four hours of its liberation and reported that "... of the inmates, 25,000 at least required urgent treatment and, of these, 10,000 would probably die before they could be hospitalized." The Second Army, took over direct responsibility for the camp, and, in addition to the R.A.M.C. Units, help was sent from all quarters. Major W. A. Davis of the U.S. Typhus Commission arrived and, with his knowledge gained at Naples, his organization of typhus control measures was invaluable.

The Belsen concentration camp was really a combination of three separate camps, and of these Camp I was by far the worst in every respect and especially in the amount of typhus fever present.

Pirrie describes it as a Dante's Inferno filled with dead and dying. The Germans admitted that the typhus epidemic had got "out of hand" and their main concern was to prevent it spreading to the German civilians in the neighbourhood. There was very little medical equipment and practically no facilities for delousing the prisoners. The only method left to them was to let the epidemic "burn itself out."

The Allied Medical personnel and helpers had as objectives :

- (1) To eradicate typhus from the area.
- (2) To prevent the spread of typhus.
- (3) To treat cases as effectively as possible.

These objectives were carried out by :

- "(1) Delousing and bathing of all from Camp I as each hut was cleared and transferring the inhabitants to hospitals or to Camp II.
- "(2) Mass disinfection of the whole of Camp I, hut by hut.
- "(3) Dusting of all workers in the camp as they entered or left the camp on every occasion.
- "(4) Immunization of all workers in the camp.
- "(5) Treatment of typhus, though this was subordinate in most cases to the treatment of starvation.
- "(6) Education of the workers in the risks they ran and in the methods of their avoidance" [33].

By the end of the month of April, 30,000 people in Camp I and 16,000 in Camp II had been dusted.

Most of the mass dusting was done with a 10 gun power duster of American design using AL 63 Mark IV (10 per cent DDT) and the American 10 per cent DDT in talc supplied by the Typhus Commission.

By the middle of May the last hut in Camp I was closed and on May 21 the camp was burned to the ground as being the only practical method of cleansing the area. Of the inhabitants at liberation 17,000 had been evacuated, 12,000 admitted to hospital and 13,000 had died—this number includes deaths from starvation and other causes as well as from typhus fever. About 3,500 cases were diagnosed as typhus and were admitted to hospital as such [33].

Terrible as these figures are, who can doubt but that they would have been greatly increased if an efficient insecticide such as DDT had not been used with energy and promptitude.

The energetic pursuance of adequate typhus control measures by trained and well-organized personnel, using modern methods and equipment and on efficient insecticide, plus the whole-hearted and fearless co-operation of people of many nations, turned the tragedy of Belsen camp into another triumph for preventive medicine in which the modern insecticide DDT figured prominently.

Far East

Scrub typhus is widespread over many areas in South-east Asia and the South-west Pacific, the causal organism is *Rickettsia orientalis* and the vector is a larval trombiculed mite.

Man possesses little natural resistance to the disease and the attack-rate is therefore high. Though scrub typhus never caused anything like the loss of manpower caused by malaria, it was feared and disliked by the soldier as, in the early days, he seemed to have little protection against it and understood little about its cause.

A great deal of work was done in the effort to find a means of protecting the soldier against the bite of the vector ; R. N. McCulloch of the Australian Army carried out exhaustive experiments in Australia and elsewhere on the properties of newly discovered miticides and the following notes are, to a large extent, extracted from his report [34].

At the end of 1942 information arrived in Australia from America, which intimated dimethyl phthalate offered valuable protection against the mite larvæ.

The hitherto accepted method of protection against the bites of these larvæ was by the impregnation of clothing with sulphur. Information from America was to the effect that the newly discovered mosquito repellents were extremely effective as miticides and remained so very much longer than sulphur. Dimethyl phthalate gave protection in the field for at least five days whilst sulphur protected only for a similar number of hours.

Experiments in Australia confirmed these findings. Dimethyl phthalate had recently been selected as the mosquito repellent to be used by the troops and when it was used as a mite repellent it gave very impressive results. At the dosage used it was found to be toxic rather than repellent to mites ; they crawled freely into treated clothes but soon died (McCulloch).

Dibutyl phthalate appeared to be as effective as the dimethyl compound. It was tried because it was known to be more readily available in Australia, while there seemed to be little prospect that Dimethyl phthalate could be produced in the quantities required for the wholesale impregnation of clothing.

Dibutyl phthalate gave protection for at least eight days, all clothing being unwashed for that period.

Dimethyl phthalate gave similar results but when the clothing was washed after the application of the phthalate it was found that the dibutyl compound remained toxic to mites for a very much longer period than the dimethyl.

Dibutyl phthalate thus appeared superior as a miticide for clothing treatment and from the point of view of supply it was undoubtedly to be preferred.

Further research on clothing treatment using DDT as well as the two phthalate compounds gave the following results :

(1) *DDT*.—When 5 grammes in a kerosene-petrol mixture were used, biting occurred after the clothes had been washed twice.

(2) *Dimethyl phthalate*.—When 1 ounce was used extremely limited biting occurred after three washes.

(3) *Dibutyl phthalate*.—When 1 ounce was tried no biting had occurred after eight washes.

Following these experiments DDT and dimethyl phthalate were discarded. Dibutyl phthalate, in view of its newly discovered resistance to washing, was re-allocated to mite control and made available to troops as supplies allowed [34]. Further "laboratory" tests were carried out to discover the effect of dibutyl phthalate on clothes under conditions such as were likely to occur on active service.

It was found that new cloth impregnated with "dressing," waterproofed cloth saturated with sweat, and wool (so long as it was washed in the correct way by squeezing and not by vigorous rubbing) would all retain their toxicity to mites after seven washes. Cotton clothes were treated and put into store and were found to have lost none of their toxicity after ninety days.

The method of application of dibutyl phthalate to the clothes has been a cause of argument since it was first started. The American scrub typhus commission recommended the dipping of clothes in an emulsion of 5 per cent phthalate in 2 per cent soapy solution. The question of following the American suggestion was considered from time to time but the decision on each occasion was that as long as the apparent result of hand treatment continued to be excellent no change should be attempted.

"Hand application," at first tested and recommended with hesitation as a stop-gap pending the development of some wholesale method, was systematized and came to be regarded as practicable and much superior to any other.

The dosage rate decided on was one fluid ounce per set of clothes, to be applied fortnightly.

The only important disadvantage of hand treatment was considered to be its tedium, and the doubt whether every man in a force could be trained to use the fluid properly, against this doubt was the knowledge that the operation was in fact no more complicated than cleaning a pair of boots and that troops really fear scrub typhus (D.M.S. Allied Land Forces S.E.A. reported in 1945 that "the effect on morale of scrub typhus has been considerable owing to its high mortality. This has been 20 per cent in British and American cases but has been reduced lately by improving methods etc.")).

The advantages of the hand method are as follows :

(1) The lack of special equipment ; each man needs only a tin such as a tobacco tin, and no large bins are needed for dipping.

(2) The fact that the method employs the full man-power of the force.

It takes about fifteen minutes to treat a set of clothes.

Anti-mite fluid was first issued to the Australian forces at the end of 1943

and was in full supply by the middle of 1944. The decline in scrub typhus after the issue of this fluid was dramatic.

For the last year of the war the mean rate of scrub typhus was about 9 per cent of the mean rate for 1943.

Major-General D. T. Richardson, Director of Hygiene, British Army, in his report on his tour of ALFSEA and India in December 1944 and January 1945 says: "Impregnation of all clothes with DBP is our most effective protective measure, giving, the experts say, nearly 100 per cent efficiency (against scrub typhus). I was informed that there was an epidemic amongst troops undergoing a course at the Jungle Warfare training centre in October, a class had 70 cases, in November the next class had 60 cases, then DBP impregnation of clothing was started and there was only one case per month subsequently."

McCullock describes a highly significant incident in the following words: "That efficiently used phthalate treatment of clothing can give protection against scrub typhus, is indicated by the history of Bat Island, a 42 acre atoll in the Purdy group North of Madang. It was abandoned in May 1944 by a small combined force after 27 men out of 46 had been infected with scrub typhus in forty-six days.

"Some members of the American Typhus Commission spent a period there in June and were unaffected due to their use of B.M.P. A Royal Australian Air Force Research unit comprising 12 men lived on Bat Island for 119 days, camping on the site occupied by the combined force in 1944, exploring the island and recovering strains of *Rickettsia* from mites and rats. The earth of tent floors and immediate surroundings was sterilized with creosote; outside the sterilized area the protection depended on was clothing treatment with dimethyl and dibutyl phthalate. All personnel escaped infection.

"For the New Guinea area as a whole, routine use of dibutyl phthalate by Australian troops was followed by a reduction in scrub typhus of more than 90 per cent" [34].

It has been shown, in preceding sections, that insecticides during the last war were decisive in their action against the louse and endemic for typhus. McCullock's reports leave little doubt about the action of dibutyl phthalate in controlling the trombiculid mite and scrub typhus.

The greatest cause of loss of man-power in the fighting line in tropical and sub-tropical climates was undoubtedly malaria, and nothing has yet been said about the action of insecticides in controlling this disease.

In the early days of fighting in such areas, casualties due to malaria were enormous, but in the latter stages of the war, admissions to medical units from this cause were very greatly reduced.

There were several factors concerned in the reduction of the incidence of malaria, they were as follows:

- (1) Insistence—often by ruthless means—on the maintenance of good anti-malaria discipline and personal precautions by all personnel.

- (2) Indefatigable and energetic action by anti-malarial units and squads in eradicating mosquito breeding places, etc.

- (3) The use of suppressive mepacrine.
- (4) The action of DDT in the destruction of the adult and larval mosquito.
- (5) The use of dimethyl phthalate as a repellent.

There is great difficulty in adjudging just where each of these factors ends and the other starts in the suppression of malaria.

The difficulty is so apparent that few, if any, medical officers who were concerned in anti-malarial administration have attempted to assess, with any accuracy, the part which insecticides and repellents played in the reduction of the incidence of malaria.

There is no doubt that the use of DDT reduced the anopheline mosquito population considerably in certain areas, or that dimethyl phthalate is a better mosquito repellent than any yet discovered.

1946-1948

Since the end of the war constant research and investigation has been carried out on the new synthetic insecticide and repellents. All the big chemical manufacturers in this country and in the U.S.A. have been trying their hardest to find an insecticide better than DDT (which they can patent) or else to produce DDT as a suitable emulsion-concentrate or wettable powder.

Sir S. Rickard Christopher published his report on Mosquito Repellents in May 1947. This was a report of the work of the Mosquito Repellent Inquiry in Cambridge during 1943-45.

Sir S. Rickard Christopher was head of the unit which carried out the most exhaustive testing of repellent compounds and described in detail the technique employed.

A number of these new formulations have been tested by the officer in charge of the Hygiene Laboratory of the R.A.M. College, his main endeavour having been to find a DDT emulsion-concentrate or wettable powder which will remain homogeneous in soft, hard and salt water, which will lay down a constant percentage of DDT, which will not leave a visible film on the surface sprayed, and which will be cheap and easily transported. So far the most suitable compound tested is a paste called "De De Tane" which contains 50 per cent DDT. The paste requires a quite considerable amount of stirring to get it to dissolve in cold water but once dissolved it fulfils most of the above requirements. One pound of paste will make 10 gallons of a 5 per cent spray fluid.

Another DDT preparation which has lately been given "field" trials is a 2 per cent DDT emulsion setting lotion, for use by the W.R.A.C., as a preventive against infestation by *P. humanis capitis*. Impregnation of clothes with DDT as a means of avoiding injury by moths has been suggested and, of course, the impregnation of shirts as a means of preventing infestation by lice was used considerably during the war.

The use of DDT incorporated in building materials (bug proofed) and paints, has been given trials. 5 per cent DDT incorporated in distemper and oil-bound water paints prove fatal to flies up to a period of one year. True oil

paint and synthetic enamel containing DDT were found not to be insecticidal [35].

Good results have been reported with whitewash, and DDT can also be incorporated in floor and furniture polish. There are three methods of dispersing DDT which were to a small extent used during the war but which will be used to a greater advantage in the future. They are aircraft, smoke and aerosols.

Aircraft spray has been used for attack on mosquitoes over forests and swamps. 5 per cent crude DDT in kerosene sprayed from tanks similar to those used for laying smoke screens, was used. Attempts have been made to disperse DDT from the air by feeding a solution into the exhaust of the aeroplane. The assessment of this method is not yet complete [36].

DDT-containing-smokes are, so far, not in general use. The smoke may be dispersed by generators, bombs or candles. The smoke candles are made of a mixture of DDT, sucrol and sodium chlorate. When ignited, a white cloud of DDT is produced, which is very effective when used in jungle, as it adheres to the underside of the leaves, a result not obtained by air-spray. On active service DDT can be included in any smoke cloud laid down for tactical reasons.

The "aerosol bomb" insecticide disperser contains 16 ounces of insecticide, which is sufficient to spray continuously for fifteen minutes. It is made up with pyrethrum, DDT, sesame oil, cycle hexanone, kerosene and Freon. It can be used for personal use as a non-residual anti-mosquito and anti-fly spray, or it can be used to eliminate temporarily the mosquito population over an area, by placing a battery of bombs to windward or by using the bomb tied to the end of a stick and spraying in 20-foot swathes, a number of operators being employed [37].

A new and lighter form of disperser has recently been produced. Benzyl benzoate, which has been used for some time in the Army as a cure for scabies, has been proved to give excellent results against the mite larvæ carrying scrub typhus.

It is now suggested that impregnation of underclothing with benzyl benzoate will act as a preventive against both these conditions.

Benzene hexachloride has been tested from time to time by the Army with the possibility in mind of substituting it for DDT. So far it has been rejected on each occasion on account of its very unpleasant smell and nose irritant. The gamma isomer (gammexane) of benzene hexachloride is a much more powerful insecticide than DDT. The Ordnance laboratories in Cawnpore, India, compared their efficiency and found that gammexane is about 50 times as active as DDT when in the form of a solution in toluene [38].

It is possible that gammexane will be used by the Army in future as an outdoor spray. It has been discovered very recently that the delta isomer of benzene hexachloride is extremely toxic to the freshwater snails *Bullinus* and *Planorbis*, the hosts of *Schistosoma*.

The dosage necessary to control the snails would also kill mosquitoes and larvæ.

There is recent information also that a really odourless gammexane has been formulated and will soon be ready for testing.

An enormous number of new synthetic compounds with insecticidal properties have been reported on recently in America. "Chlordene" (probably a mixture of isomers) and "Toxaphene" (a chlorinated camphene) are two of the best. Sufficient data are not available to judge the value of these insecticides but they seem to be less insecticidal than gammexane and less persistent than DDT [39].

SUMMARY

- (1) Excuses (or reasons) are given for writing a historical summary.
- (2) From 1848 to 1914 the evolution of the aetiology of some of the most important tropical diseases is traced. The preventive action of insecticides and repellents in dealing with these diseases is noted.

The names of some of our early Professors of Hygiene are abstracted from the Army Medical Department's Reports and are noted down, their readiness to accept new facts of medical science is acclaimed.

- (3) The many advances in combating insect-borne disease which took place during the 1914-18 war, especially in anti-fly measures, are commented upon.

- (4) The period between the two wars is chiefly notable for the fight against the bed-bug which later was winning comfortably.

- (5) The 1939-45 war saw the appreciation of the limitless uses of DDT and of the new repellents.

The typhus epidemic in Naples is briefly described and it is noted that a pyrethrum-containing insecticide was responsible for its initial collapse.

Some few remarks are made on Belsen Concentration Camp and its typhus outbreak.

Dibutyl phthalate and its effect on the incidence of scrub typhus are described.

- (6) Some recent advances in insecticides since the war are recorded.

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Clinical and Other Notes.

THE B.A.O.R. SKI AND SNOW WARFARE SCHOOL

BY

Lieutenant R. J. A. NICOL
Royal Army Medical Corps

WHEN we arrived by train at Bad Harzburg, we were met by a cheerful sergeant who quickly began to tell us of the ordeals we were about to face. We climbed into the waiting transport and proceeded uphill over roads now deep in snow, into the blizzard that was raging, leaving behind the security of the houses at the leave centre. Higher and higher we climbed and the snow-storm increased and rocked our vehicle whenever we left the shelter of the firs and crossed a patch of open road. Neither the steady increase in height nor the thickness of the snow helped in any way to lessen our apprehension of the unknown that lay ahead of us, for we had ceased to see any signs of habitation.

St. Andreasberg, which is one of the highest villages in the Harz Mountains is a charming place. The wooden houses with their varied architecture are dotted along a road which disappears steeply into the valley. All around are beautiful rolling hills, some with gentle, and some with almost perpendicular, slopes possessors of unbroken whiteness or tree-clad wealth.

Two hotels, the "Tannhäuser" and the "Schützenhäus" were taken over and became our homes for the next four weeks. They were comfortable, warm and most welcome after the outside cold or penetrating wetness. Every morning after breakfast we waxed our skis—an art which is not too quickly acquired, because much depends on one's choice of wax for the prevailing snow conditions—and, as we smoothed it out with our hands not a few of us had our enthusiasm rewarded with blisters on our palms.

A steep and tiring climb up-hill with skis on our shoulders brought us by 9 o'clock to the "parade ground" on one of the hills, where, in squads of six, each under the instruction of an expert Norwegian skier, we were introduced to and trained in the art of ski-ing. For the first two or three days we were taught to find our balance and ski on the level, up or down hill without sticks so that we would be able to use our legs and bodies to the best advantage when later we would have sticks to help us. Downhill braking in deep snow, hard snow, new snow, slowly or at speed had all to be learnt, and the practice of falling in the correct way at the proper time were all of paramount importance. 12 o'clock would come and with it the return to lunch, or, in the snow, sandwiches and hot tea from our thermos flasks; at 1.30 we would recommence our practice continuing until 4.30. Sometimes, in the evening, we would have a lecture on equipment, tactics in snow warfare or bivouacking in the snow, and at other

times a film show given by the A.K.C., but few were the occasions when anyone stayed up late. No one ordered us to bed but pleasant tiredness after our day's labours made us seek our beds early, so that we might be armed against the ardours of the morrow.

Saturday afternoon and Sunday were free but many of us would go out ski-ing, or watch downhill racing or jumping in the village, at Braunlage or at Altenau. If our Norwegian instructors entered for any of these winter sports competitions, not only would we be assured of a worth-while exhibition, but also of seeing their unfailing and unbeaten success.

Every week we would have a slalom competition—a downhill race with very many sharp turns—and a cross-country race which was gradually increased from about 2 to finally 10 kilometres. The latter involved crossing flat country, climbing as much as 200 metres, manœuvring through very thick woods, over rough and uneven ground, across slopes or speeding downhill through trees with all the associated hazards of unexpected turns and half-hidden tree stumps.

One morning we set off with packs and sleeping bags on our backs, which combined, made us tired even after five minutes. Through the woods we skied taking turns at pulling the sledges, which operation thoroughly exhausted us on skis if we were unfortunate enough to have to climb a hill in the process. Finally we reached Ski Kreuz, the top of a hill from which many excellent ski runs start. Nearby we could see the Russian Zone and a look-out post. Some then began digging a well about eighteen feet in diameter and two feet deep in which we pitched our Swedish tent. Others busied themselves with cutting small fir branches which were interwoven to form a floor about one or two feet in depth, for our tent. The remainder cut and chopped firewood for our stove, which was the bottom of the hollow iron tent pole—the stove's chimney. Outside everything was cold and wet and before the tents were pitched we were soaked to the skin, longing to change into dry clothes and hang our wet ones in the tent to dry. By the time fourteen of us had unrolled our sleeping bags, there was not much room to move. We each took it in turn to act as fireguard in the tent for one hour. Needless to say, an equally important job was to stoke the fire, for it was essential to keep warm, be well rested and have dry clothes. The food was brought up in weasels and was always most welcome.

Next morning some students preferred to remain dirty but some of us washed in snow with snow, and rubbed snow over arms and bodies. Terrifying it seemed and not a little frightening the experience, but we were rewarded by a most pleasant and invigorating feeling. The rest of the day, which was very wet, was spent ski-ing through or in the woods in the heavy cloud that surrounded us. The following morning camp was struck and after about two hours we returned to St. Andreasberg to have a Finnish bath. I feel sure this was designed by someone who had either much leisure time or wished to waste much. It consisted of two tents. In the first you stripped completely and later dried yourself, while in the second, which was heated by a large red hot stove, the floor covered with sawdust and all holes and ventilators blocked, you sat or stood on chairs until with the heat, the sweat poured from you. Thereafter

you dived from the tent and rolled in the snow. A feeling of well-being should and did follow this truly courageous act.

Accustomed as we all are, either in Britain or Germany to a damp and penetrating cold, it was a novel and delightful experience to work and perspire while lightly clad and become quite sunburnt, at a temperature of -5° C. All that we usually wore were ski boots and two pairs of socks (preferably made of oiled wool), denims and green khaki windproof and water-repellent camouflage trousers and smocks, with sometimes a heavy pullover below, which came as high up as a polo-neck jersey but without the large roller neck. Often we were much too warm with this and skied in the minimum of clothing, but in stormy weather we wore heavy smocks two layers thick, of windproof and water-repellent material trimmed with fur. We did possess white camouflage but fortunately it was not our regular dress as it was bulky, neither waterproof nor water-repellent, and when wet was much too heavy. We wore woollen gloves with or without white leather gauntlets which, incidentally, would get soaking wet, freeze and increase many times the dangers of frostbite. Occasionally we wore sun goggles but fortunately they were not for daily use as they were much too heavy, fitted badly and cut down considerably the normal range of vision.

Our food was similar to the normal British soldiers' ration and proved both too bulky as far as vegetables and starchy goods were concerned, and inadequate in the amount of energy-producing food, such as meat and fats.

There were, throughout our four weeks, no casualties of any grave severity, no broken bones, and only mild sprains of the ankles, the knees and the thumbs—a fact which, in itself, says much for the excellent instruction we received.

The last day of the course arrived and diplomas were presented with the Bronze Norwegian Ski Badge to the students. Many of us felt that although we had progressed so far in our ski-ing abilities we would not like to have to see action with our present knowledge. We were, however, much encouraged when we were told that probably half of us would already be able to fit into a Norwegian ski platoon—this after only one month on skis.

We could not speak too highly of our instructors. Their untiring energy, enthusiasm and patience coupled with the ceaseless efforts of Colonel Tanum, the chief instructor, who accompanied us at all times as we trained, encouraging us and correcting our faults in a kindly and considerate way, were an unflinching inspiration to us.

Notices

THE ARMY BENEVOLENT FUND

ALTHOUGH The Army Benevolent Fund is now approaching the fifth anniversary of its creation, there is still a large number of people interested in the Army who are ignorant of the Fund's existence or unaware of its objects.

During the last war large sums of money accrued from the surplus NAAFI profits and from the gifts of people anxious to express their appreciation of and gratitude to the Army for their splendid achievements in the various theatres of the war.

In order that this money should be equitably distributed the Army Council created the Fund in the summer of 1944, with Field-Marshal The Earl of Cavan as its first President, and a Board of distinguished officers and civilians.

Unlike the Royal Naval Benevolent Trust and the R.A.F. Benevolent Fund, the Army Fund does not deal directly with the needs of the individual. With a network of corps and regimental associations scattered all over the British Isles, in addition to the Soldiers', Sailors' and Airmen's Families Association and the Forces Help Society, there already existed the necessary machinery for investigating the needs of individuals and of giving the immediate and adequate assistance which each case deserved. The charitable funds of corps and regimental associations, which in pre-war days found it hard to meet the needs of the comparatively small regular and Territorial Army, were in most cases quite unable to deal with those of an Army which at the height of the war numbered four to five million men and women.

The task which The Army Benevolent Fund set itself, therefore, was to ensure that these funds were given adequate financial help in order that as many cases of hardship as possible should be relieved. The amount of money now being distributed by The Army Benevolent Fund should enable assistance to be given to individuals on a scale which should make it possible for them to make a fresh start. Very many regiments, if they had to rely entirely on their own resources, could only give such small amounts to individuals as would have no permanent effect on their future.

Nearly one and a half million pounds have already been given by The Army Benevolent Fund to the many charitable organizations which alleviate distress among soldiers and their dependants. It has been decided that priority in making grants shall be given to corps and regimental benevolent funds, and in consequence it is becoming necessary to reduce the amounts to be given to combined service associations. It is unfortunately clear that demands to alleviate individual distress are steadily increasing, and, in spite of help from the Fund, corps and regimental funds may find it difficult to meet all the demands made upon them. It is hoped, therefore, that regimental funds may be partly re-

plenished from local resources, from members and ex-members of the regiment, or from friends who have a special interest in contributing to the needs of the less fortunate.

Help is also being given to the many organizations concerned in the training of the disabled and the care of the aged and of orphaned children. Furthermore, by making grants to appropriate organizations The Army Benevolent Fund is contributing towards the education and technical training of those young people who have either served in the Army or whose parents have done so. Many of these young people, who can ill-afford to pay the fees at Universities and Training Colleges, are being helped with money provided by The Army Benevolent Fund to qualify for professional and business careers, and many children orphaned by the war are thus able to obtain the education which their fathers would have provided for them.

The object of this article is to give a short account to all soldiers, ex-soldiers and their friends in order that they should have a greater knowledge of the work being done by The Army Benevolent Fund.

Review

ATHLETIC INJURIES. By Augustus Thorndike, M.D. Published by Henry Kimpton. Pp. 243. Price 18s. 6d.

Dr. Augustus Thorndike, M.D., has had fifteen years' experience at Harvard University in the treatment of injuries amongst the undergraduates especially those indulging in "body contact sports." He is assisted in his work by 9 part-time surgeons, 2 full-time trainees, 4 part-time masseurs and a roentgenologist: American students playing games seem to be under really adequate medical supervision. The number and type of injuries sustained in different games are set out in numerous tables. Treatment of each is discussed in detail. He finds that "among 16,000 participating athletes only 33 semilunar cartilage injuries have been found and of these only 6 necessitated operation" (p. 198). A blister is treated by incising the edge, evacuating the contents and swabbing the interior with Tct. Benzoini Co. (p. 118). Epidermophytosis necessitates "the compulsory use of the antiseptic foot bath (1 per cent sodium hypochlorite fresh twice weekly) before entering and leaving the shower room:" the disease is treated by 1 per cent methylene blue in alcohol daily and 3·5 per cent tincture iodine for three days for more stubborn cases (p. 120).

Perhaps the most interesting part of the volume is the introductory group of chapters dealing with physical fitness: Training, Fatigue and Further Aids in the Prevention of Injury.

A book to pick up for an occasional half-hour in a library and dip into with pleasure and profit.

J. F. S.

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July, 1949.

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OF

THE



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Medical Corps

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MONTHLY

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Journal of the Royal Army Medical Corps.

Complimentary

SIR ALEXANDER HOOD

WE are certain that all our readers will wish to join us in conveying to Sir Alexander Hood, *G.B.E., K.C.B., M.D., F.R.C.S., F.R.C.P., LL.D.*, our congratulations on his appointment to the Governorship of Bermuda. Fresh from his successful period of office as Director-General of the Army Medical Services during the most trying period of our history, he takes with him to his new task qualities of head and heart which, aided by his experience of successfully negotiated difficulties during the war years, augur well for his success in this new rôle to which he has been called. The mantle of governorship sits fittingly and becomingly on his shoulders. He takes with him the good wishes of all past and present members of the Royal Army Medical Corps for a successful and happy tour of duty in the once-vexed Bermuthes.

It is interesting to recall previous occasions on which Army Medical Administrators have been appointed to governorships or similar appointments.

The best remembered is Sir John Goodwin, *K.C.B., K.C.M.G., D.S.O., F.R.C.S.*, who was Governor of Queensland from 1927 to 1932. The Queensland Government asked that his tour should be extended but, for personal reasons, Sir John was unable to accept this offer.

There are two other officers whose services as administrators are worthy of recall:—

BRIGADE SURGEON VALENTINE STREPTON GOULDSBURY, *C.M.G., M.D.*, was Civil Commandant, Accra, and administrator of the Settlements on the River Gambia in 1877. He was later administrator of St. Lucia and its Dependencies and also of the Windward Islands in the event of the absence of the Governor, in 1891.

BRIGADE SURGEON SIR SAMUEL ROWE, *K.C.M.G.*, who had distinguished himself in the Ashanti Campaign of 1873 was appointed Governor and C. in C. of the West African Settlements on June 12, 1877, and on January 28, 1881, became Governor and C. in C. of the Gold Coast and Lagos. He was again Governor and C. in C. of the West African Settlements on December 30, 1884. He died in Madeira on his way home on August 28, 1888. He showed special gifts in dealing with West African natives by whom he was known as "Old Red Breeches."

Original Communications.

CLINICAL MANIFESTATIONS OF TICK-BORNE RELAPSING FEVER WITH SPECIAL REFERENCE TO THE DISEASE IN CYPRUS

BY

N. F. COGHILL, M.A., M.B., M.R.C.P.

*Physician, West Middlesex Hospital
Late Major R.A.M.C., Medical Specialist*

EPIDEMIOLOGICAL and entomological aspects of relapsing fever in Cyprus have been discussed previously by Gambles and Coghill (1948). In this communication the clinical features of the disease in the island are presented, followed by a discussion on the possibility of clinical differentiation of tick- from louse-borne forms as they occur throughout the world.

Records were collected of 35 military cases infected in Cyprus, which came under my care. 29 were Indians, 1 a Cypriot and 5 English. All had positive blood films.

Both forms of relapsing fever, perhaps especially the tick-borne, show considerable variation from case to case and locality to locality. The author's experience proved no exception to this and illustrative case histories are given.

The following examples are representative of what may be termed "straight-forward" cases:

Case 16.—Indian, Sepoy, aged 40. Admitted to 82 General Hospital (82 G.H.) on 22.6.42. Fever and headache without rigor, started on 17.6.42. There were generalized body and joint pains. He was still febrile on admission and a blood film contained spirochaetes. He was given sulphostab 0.3 gramme intravenously (I.V.) and five days later 0.45 gramme. Discharged to unit on 30.6.42.

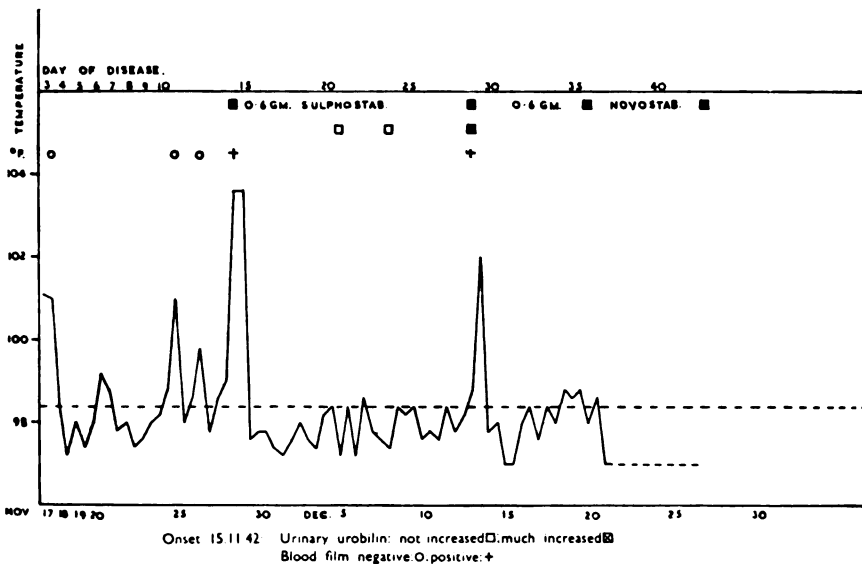
He relapsed, and was readmitted, on 8.7.42. He received no treatment and relapsed again with a rigor on 16.7.42, the day he was transferred to another hospital. While at this other hospital it is not known if he had any treatment, but there appear to have been no further relapses. Discharged to unit on 28.7.42.

On the same day he experienced his third relapse and was admitted to a staging section. A fourth relapse occurred on 2.8.42 when he was noted to be tender in the liver area. He had a fifth relapse on 10.8.42. A sixth occurred on 21.8.42 (T. 103° F.). He was admitted once more to 82 G.H. on 23.8.42, symptomless. On 1.9.42 he complained of pain over the spleen which was found enlarged and moderately tender. The liver was just palpable and not tender. The next day the patient shivered and his temperature rose to 102.4° F., constituting the seventh relapse. On this occasion the spleen was difficult to feel but he remained moderately tender in the area of that organ. In error treatment was not given.

Eighty-one days after the onset the patient went to Convalescent Depot (Con. Dep.) on 5.9.42. and thence to unit on 3.10.42. There were no further relapses.

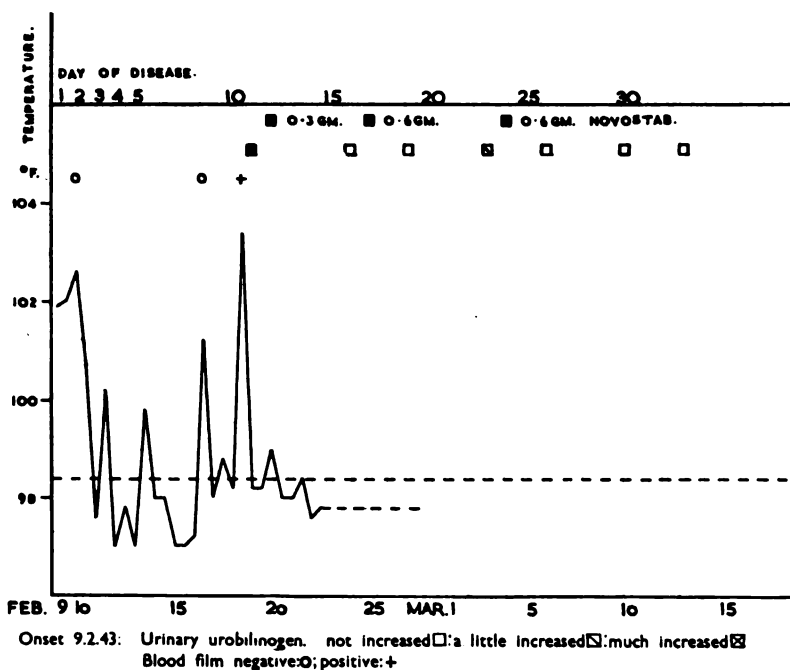
Case 27.—U.K. Serjeant, aged 27. Admitted to 82 G.H. on 17.11.42. Onset on 15.11.42 with a feeling of cold (no shivering); headache; pain in the legs, back and loins; considerable nausea but no vomiting; a feeling of weakness; temperature 100° F. The next day he felt worse except for the nausea which was eased, and he developed a moderately severe continuous epigastric ache. Apart from fever (*see chart*) the only physical sign was moderate tenderness over the liver and in the epigastrium. A blood film was negative. There was general improvement as the fever diminished. A leucocyte count on 26.11.42 was normal (Table II). On 28.11.42 he complained of malaise, pain in the arms, severe backache and mild headache; he was rather prostrated; a blood film contained spirochætes as the temperature rose; sulphostab 0.6 gramme I.V. was given at the height of the fever. The next day he was very much improved. There were no symptoms by 30.11.42, but the following day he developed a tender point on a left lower rib giving rise to occasional shooting pains in this area for a day or two. Thereafter he was well until 12.12.42, when a lumbar ache appeared and he felt "very tired." He slept little that night and the next day had severe backache and frontal headache, and mild pains in the legs. There was more fever (second relapse) and a blood film was again positive. His urine contained much increased quantities of urobilin (*see chart*). Novostab 0.6 gramme I.V. was given as the temperature was rising. Later he vomited twice. The next day he was much improved and became symptomless by 15.12.42. Novostab 0.6 gramme I.V. was repeated on 20.12.42 and 27.12.42. Discharged to unit on 21.12.42. There were no further relapses.

TEMPERATURE CHART. CASE 27.



Case 30.—Indian, Sepoy, aged 22. Admitted to 82 G.H. on 10.2.43. Onset on 9.2.43 with fever, malaise, headache and rigors. On admission there was further shivering but no other physical signs. Blood films were negative. The symptoms and temperature did not properly settle (*see chart*) but what was probably a true relapse occurred on 18.2.43, with the first positive blood film. The next day the temperature dropped and he had no symptoms, although the spleen was just palpable and the urine contained a great excess of urobilinogen. Novostab 0.3 gramme I.V. was given on 20.2.43; 0.6 gramme on 25.2.43, and on 4.3.43. He remained well until 9.3.43, when he had a frontal headache, severe at times, for two to three days; there was no fever. Thereafter he remained well and was discharged to Con. Dep. on 16.3.43. There were no further relapses.

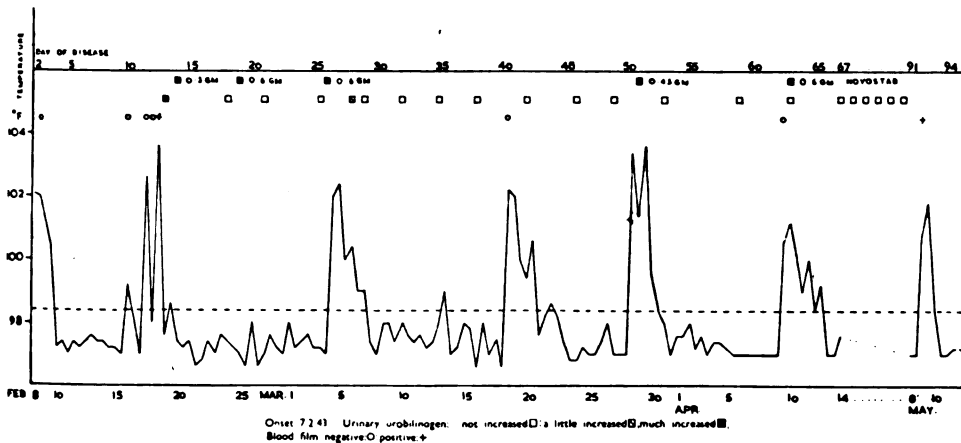
TEMPERATURE CHART. CASE 30.



Case 33.—Indian, Sepoy, aged 21. Onset of fever with a rigor on 7.2.43 and the next day was admitted to a staging section. There he had a cough with expectoration. The lungs contained numerous rhonchi and the spleen was felt. This attack subsided and he was admitted to 82 G.H. on 15.2.43 when his complaints were vague pain in the chest, persistent cough and malaise. He was afebrile (*see chart*). The first relapse started on 16.2.43; he had rigors and some back pain; a positive blood film was first obtained on 18.2.43; cough continued; he became moderately tender over the liver. Urinary urobilinogen was much increased on 19.2.43. He received 0.3 gramme novostab I.V. on 20.2.43 and 0.6 gramme on 25.2.43. The cough improved over a period of days and disappeared, but the tenderness in the right hypochondrium persisted although the liver was not felt. The patient felt weak. On 3.3.43 the tenderness spread to the left hypochondrium, but the spleen was not palpable. The next morning he received his third injection of novostab (0.6 gramme) in spite of which his temperature rose from normal to 102° F. that evening. He was moderately ill with this attack. There was pain across the front of the chest, and pains all over the body; and on 6.3.43 vomiting and occipital headache. This was his first complaint of headache. Bronchitis reappeared; his abdomen was moderately tender in umbilical and epigastric areas, and along both costal margins, with some abdominal wall resistance; no organs were felt. There was slight neck stiffness. He was greatly improved the next day. On 10.3.43 he complained only of painful muscles over the front of the chest and upper abdominal aching pain. The pectoral muscles remained moderately tender for some days; the upper non-muscular abdominal tenderness remained as before. The fundi were normal. On 13.3.43 the knee and ankle jerks, previously always brisk, were found to be equal and sluggish. Three days later, although symptomless, his upper abdominal tenderness had increased and the liver was now palpable one finger's breadth (f) below the costal margin. At this time there was a mild leucocytosis (Table II). On 18.3.43 his third relapse appeared, with headache. By 27.3.43 his tendon-jerks were brisk again, those at the knee being mildly exaggerated. A fourth relapse occurred on 28.3.43, with headache, vomiting insomnia and rigors. There was a constant aching pain along both costal margins with

tenderness as before. The spleen could now be felt $1\frac{1}{2}$ f. below the costal margin which was considerably tender. Novostab 0.45 gramme was given as the temperature was on the second up-grade. Between this relapse and the next he became symptomless and the abdominal signs diminished to slight epigastric tenderness. The fifth relapse started on 9.4.43 with vomiting, epigastric pain and mild headache. During the night he passed 9 loose stools containing mucus but no blood. The abdominal signs were as in the previous relapse. Novostab, 0.6 gramme I.V. was given on 10.4.43 as the temperature was falling. The abdominal symptoms and signs slowly diminished and then began to reappear on 29.4.43; the liver was again felt on 1.5.43. At this time he looked and felt far from well, and had obviously lost a considerable amount of weight. The abdominal signs again diminished after 5.5.43 but a relatively symptomless sixth relapse occurred on 9.5.43. He became free of symptoms and signs on 13.5.43 and began to put on weight. Discharged to unit fit on 4.6.43, 118 days after the onset. There was no further fever.

TEMPERATURE CHART. CASE 33.



The following are histories of those cases with complications: *Cases 18, 22 and 25* are examples of meningitis; *Case 34* of encephalitis and *Cases 10 and 32* of facial palsy. *Cases 18, 22, 25 and 34* developed varying degrees of papilloedema during the course of their neurological complications.

Case 18.—Cypriot, Private, aged 20. Admitted to a surgical ward in 82 G.H. on 29.7.42 as a case of acute appendicitis. The previous day there had been a sudden onset of pain in the right abdomen. The pain was worst at a point above and to the right of the umbilicus, and was constant and aching in character. He felt tired and ill; there was nausea, fever without shivering, headache, dry cough and an aching pain down the length of the back. He had had no similar illness before. On admission he appeared flushed and ill. The surgeon noted that there was no abdominal resistance but the patient was very tender over McBurney's point. The liver was palpable 2 f. below the right costal margin on inspiration and considerably tender; the spleen was similarly enlarged 2 f., hard and not tender. The diagnosis of appendicitis was doubted.

During the next four days he was constipated; blood films were all negative; the temperature became normal by 31.7.42 (see chart); X-ray of lungs and liver areas showed nothing abnormal; 3 W.B.C. counts were normal (Table II).

He was transferred to a medical ward on 3.8.42 with a tentative diagnosis of amœbic hepatitis. At this time he felt better in himself, but the backache and abdominal pain remained fairly severe, the last being worse when lying on his right side. The abdominal tenderness was now most marked over an area a little above and to the right of the

He continued to complain of headache which became worse and on 23.8.42 moderately severe. The pain was frontal and behind the eyes. The temperature was 99.6 F. and the only sign was the enlarged spleen noted before. The next day there was a morning temperature of 99.8°. On 25.8.42 he began vomiting. The headache was then severe and general; he was ill and drowsy; there was pain on moving his eyes and severe anorexia. There was marked neck rigidity but no Kernig's sign. The condition remained unchanged with persistent vomiting until 27.8.42 when the first lumbar puncture was performed, 7 c.c. clear colourless fluid being withdrawn (Table I). The next day there was no vomiting but occasional nausea and the same headache. For the first time there were now further signs in the C.N.S.; knee-jerks sluggish; all arm-jerks absent on the right. Fundi, moderate and equal; papilloedema, most marked on the left. His vision deteriorated, but later recovered. Blood Kahn reaction negative. The condition was much the same on 29.8.42 when a second lumbar puncture was done. On this occasion 20 c.c. fluid (clear and colourless) were slowly withdrawn with coincident improvement of the headache. This was only slight the next day and the neck stiffness began to improve. The knee-jerks were now a little brisker. Fundi: very considerable oedema of the discs whose margins were almost invisible; vessels very congested. For the first time since 23.8.42 the temperature was 99° F.

TEMPERATURE CHART. CASE 18.

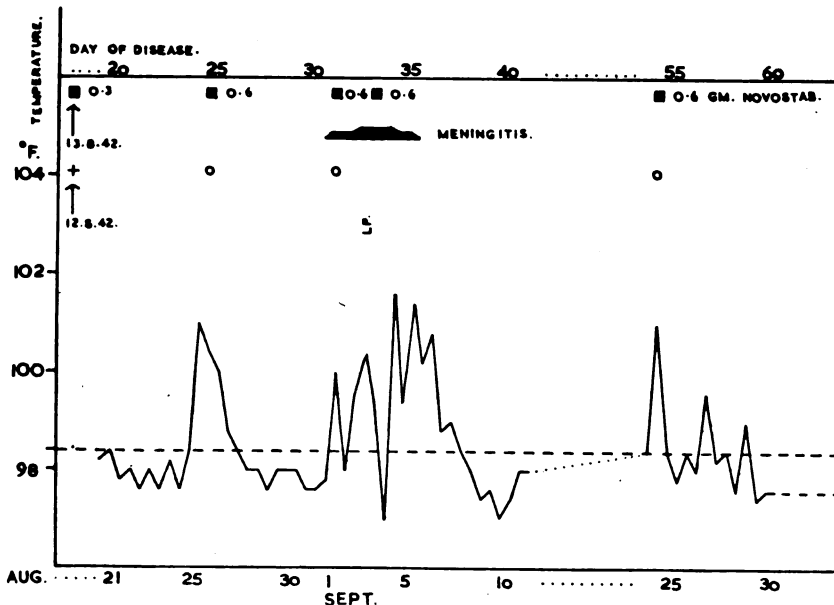


fundi remained the same except for the discs becoming slightly paler. A third lumbar puncture was performed, 15 c.c. clear colourless fluid being taken off. The Kahn reaction on the c.s.f. was negative. At this time there was mild vomiting but the headache was relieved by the lumbar puncture. He now began to run a low fever. The condition remained the same until 5.9.42 when novostab 0.6 gramme I.V. was given. Thereafter he slowly improved, gaining all the considerable amount of weight he had lost, and he made a complete recovery in every way. The spleen remained the same throughout. Discharged to Con. Dep. on 18.9.42. There was no further fever.

Case 22.—Indian, L/Naik, aged 20. Fever and headache first appeared on 2.8.42. He was admitted to another hospital on 5.8.42 and again had fever on 6.8.42 (first relapse). Blood films were negative and he was discharged on 8.8.42. The second relapse occurred on 12.8.42 for which he was readmitted to the same hospital. On this occasion it was noted that the liver was impalpable, but the spleen was felt one inch below the costal margin. Spirochaetes were now found in a blood film. The next day a blood Kahn reaction was doubtfully positive and he received 0.3 gramme novostab, I.V.

He was transferred to 82 G.H. on 21.8.42, complaining of slight headache and pain in the back. The third relapse occurred on 26.8.42. On this occasion the blood film was negative. He was given novostab, 0.6 gramme I.V. during the fever, and his temperature became normal by 28.8.42. On 30.8.42 the liver was mildly enlarged, and the spleen moderately so and hard. On 1.9.42 there was more fever (fourth relapse) and headache. A blood film was negative and he was given novostab 0.6 gramme I.V. He improved the next day but on 3.9.42 complained of a severe general headache. There was now marked neck rigidity with mild fever (*see chart*). Fundi: mild papilloedema. A lumbar puncture was performed (Table I) and 4 c.c. clear colourless fluid withdrawn. The headache was almost completely relieved at the time by this operation. The same day he was given a further 0.6 gramme novostab, I.V. in error. On 6.9.42 he began to complain of aching pain in both sternomastoid muscles, which were tender. This continued, otherwise with general improvement, until 11.9.42 when he again had a severe

TEMPERATURE CHART. CASE 22.

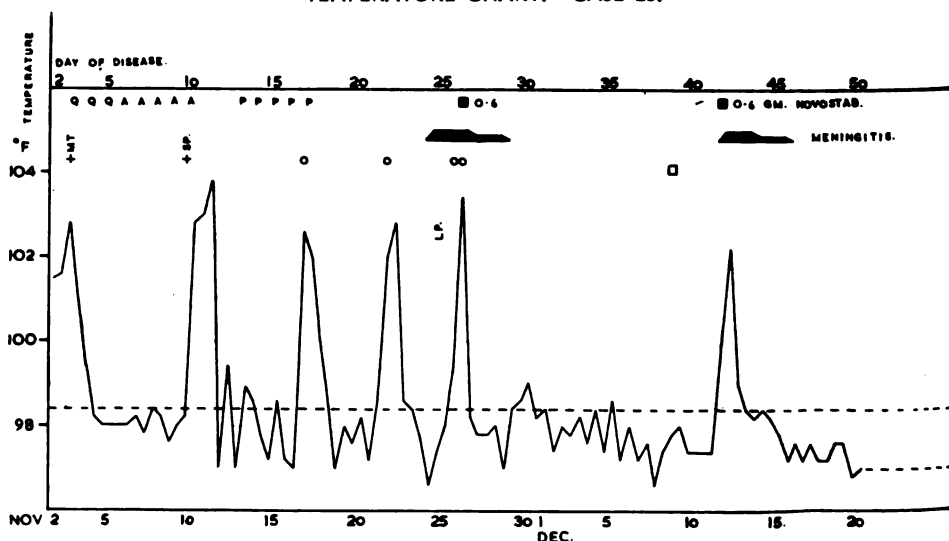


headache for twelve hours. The next day there were no symptoms and on 21.9.42 he was sent to Con. Dep. apparently well.

Two days later he had a headache and on 24.9.42 the fifth relapse occurred. A blood film was negative. He was given 0.6 gramme novostab, I.V. Mild pain and tenderness of the sternomastoid muscles recurred the next day, and persisted for some days. The temperature rapidly became normal after the novostab, but was 99.6° on 27.9.42 and 99° two days later. Thereafter he made a complete recovery, being discharged fit to his unit on 12.10.42. There was no further fever.

Case 25.—Indian, Sepoy, aged 22. Taken ill on 1.11.42 with fever, shivering, headache and lumbar pain. Admitted to another hospital on 3.11.42 when *P. falciparum* were seen in a blood film. Routine malaria treatment was started and he was transferred to 82 G.H. on 9.11.42. The next day there was more fever (*see* chart) and spirochaetes were found in a blood film. Taking this as the primary attack of relapsing fever his first relapse was on 17.11.42 with the sudden onset of fever, headache and pains in the legs. This subsided, but on 21.11.42 he began to complain of frontal headache, worse at night; lumbar pain; mild leg pains. The abdomen was mildly tender in the L.I.F. and left hypochondrium but no organs were felt. The lumbar muscles were very tender on both sides. There was moderate neck stiffness but no Kernig and no other C.N.S. signs. There was further fever the next day and he vomited. On 25.11.42 he had a severe frontal and mild occipital headache. He was more tender in the L.I.F. The neck stiffness had increased. Fundi: mild papilloedema on the left. On lumbar puncture 12 c.c. clear colourless fluid were withdrawn under a pressure of 130 mm. of c.s.f. This was normal in every way, and contained no cells. The headache was somewhat relieved by this operation. The next day the third relapse occurred and for the first time novostab, 0.6 gramme I.V. was given, when the temperature was at its peak. Two days later he was improved but lumbar ache and tenderness, and moderate neck stiffness, persisted. The knee-jerks were now very sluggish, but equal, and the ankle-jerks mildly reduced; previously all had been brisk. The fundal appearances remained the same. Four days later there was further improvement and the tendon reflexes were normal again. The left disc did not become normal until 9.12.42. The blood Kahn was negative

TEMPERATURE CHART. CASE 25.

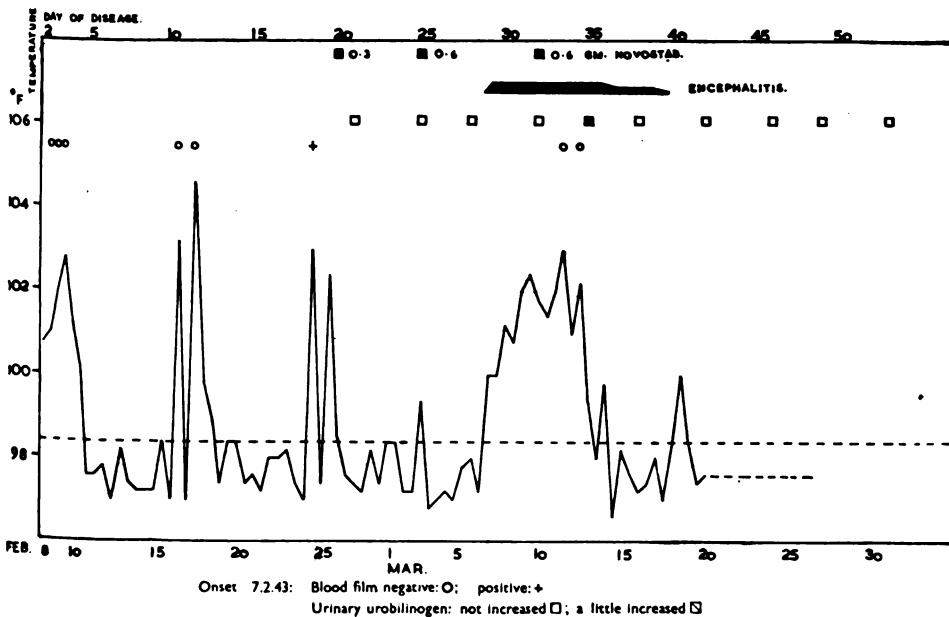


Onset 1.11.42: Blood film negative for Spirochaetes: O: positive: + sp
 Blood film positive for *P. falciparum*: + MT
 Urinary urobilin: not increased □
 L.P.: Lumbar puncture: Q: Quinine; A: Atebrin; P: Plasmoguin.

on 2.12.42. Mild lumbar pain and tenderness persisted, with occasional headache and pains in the thighs until 12.12.42 when the fourth relapse appeared with exacerbation of all the symptoms he had had back to 25.11.42. Neck stiffness reappeared and all the lower limb tendon reflexes were very sluggish. He was given 0.6 gramme novostab, I.V. Thereafter he slowly improved. The spleen was felt 1 f. down for the first time on 16.12.42. The knee and ankle jerks were normal on 26.12.42 but those at the knee were again very sluggish on 6.1.43 by which date he became free of symptoms. Discharged fit to unit on 11.1.43. There was no further fever.

Case 34.—Indian, Sepoy, aged 22. Onset on 7.2.43 of fever with malaise (*see chart*). Admitted to a staging section where he had signs of bronchitis. He complained of pain over the right chest in front, and vomited once. He had a headache most evenings until admitted to 82 G.H. on 15.2.43. The next day the first relapse occurred with a rigor and joint pains. The second relapse appeared on 24.2.43 when a positive blood film was obtained for the first time. He was given 0.3 gramme novostab, I.V. on 26.2.43 as the temperature was falling. At this time the liver edge could just be felt, and was moderately tender. The spleen, not previously palpable was enlarged 2 f. downwards, soft, but not tender. On 3.3.43 there was no abdominal tenderness and the spleen was smaller. He received novostab 0.6 gramme I.V. The third relapse occurred on 7.3.43 and fever continued for eight days. At first he complained only of headache and malaise but the knee-jerks, previously normal, were sluggish on 10.3.43. On this date he received novostab 0.6 gramme I.V. He became lethargic and a little drowsy with a severe headache, and on 13.3.43 the knee-jerks were absent and ankle-jerks a little diminished for the first time. At no stage was there neck stiffness. By 16.3.43 the leg reflexes were recovering but a mild degree of bilateral papilloedema had developed. There was no anaemia and the W.B.C.s were normal (Table II). The fourth and last relapse (very mild) occurred on 18.3.43. Thereafter he improved rapidly in every way. The spleen remained 1 f. palpable and became much firmer. On 24.3.43 there was a slight leucocytosis. Discharged fit to unit on 23.4.43. There was no further fever.

TEMPERATURE CHART. CASE 34.



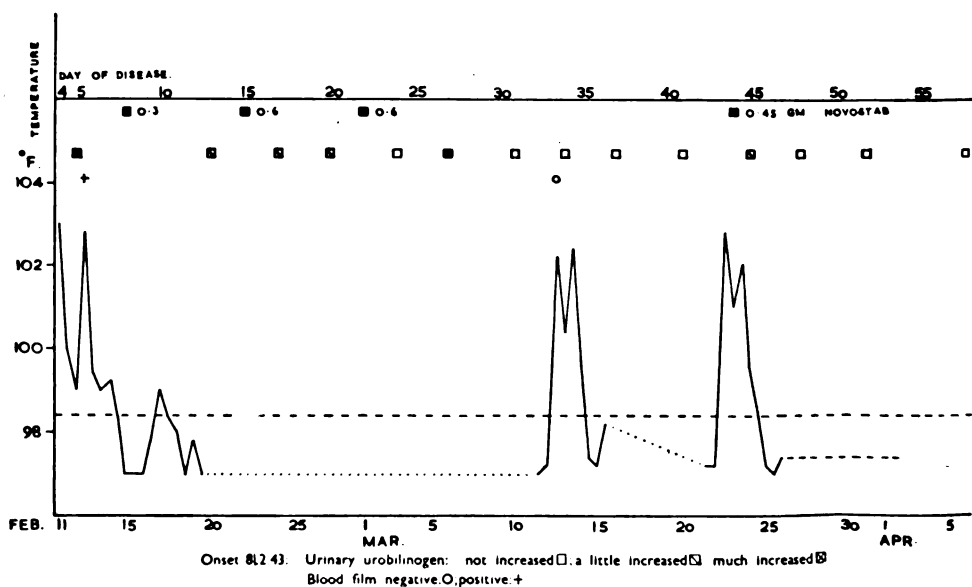
Case 10.—Indian, Sepoy, aged 20. Onset of fever on 31.5.42 and admitted to 82 G.H. on 4.6.42, still febrile. He complained of a "head cold" and sore throat but throat signs were minimal. He was tender in the epigastrium and the spleen was palpable 1 f. A blood film showed spirochætes. On the day of admission 0.3 gramme sulphostab was given I.V.; five days later 0.45 gramme and seven days after that 0.6 gramme. Discharged to unit on 16.6.42, no further fever having occurred since 5.6.42.

Thirty-one days after the end of the first attack he relapsed, with a rigor. He was readmitted to 82 G.H. on 8.7.42 and the blood film again contained spirochætes. He had a right Bell's Palsy which had appeared with the relapse of the fever. The paralysis was unilateral, complete, and of lower motor neurone type. He received no treatment.

On 5.8.42 his temperature rose again, with a rigor, and on this occasion *P. vivax* only were found in a blood film. This fever responded normally to routine malaria treatment. No further fever occurred. The facial paralysis had shown no sign of improvement by 26.8.42 (fifty-three days after its onset) when he had to be transferred to another hospital.

Case 32.—Indian, Havildar, aged 35. Admitted to 82 G.H. on 11.2.43. Onset on 8.2.43 of a dull aching pain in all his joints. Fever (*see chart*) began on 11.2.43 with rigor, malaise and anorexia. The spleen was enlarged 1 f. A blood film contained spirochætes on 12.2.43, but novostab, 0.3 gramme I.V., was not given until 15.2.43, when there were no symptoms, and was repeated on 22.2.43. On 24.2.43 the spleen remained as before, and the liver became transiently enlarged 1 f., but not tender. Novostab, 0.6 gramme was given on 1.3.43. He was afebrile and symptomless from 15.2.43 until 12.3.43 when the first relapse occurred with rigor and slight headache. The spleen was now enlarged 2 f. and rather hard. The knee-jerks, previously brisk, were now sluggish, but became normal again on 16.3.43. The second relapse appeared on 22.3.43. He had a rigor but no headache. Novostab 0.45 gramme was given on 23.3.43. The next day he complained of tightness and "uneasiness" in the abdomen, which was not distended but was a little tender along the right costal margin. The liver was not felt but the spleen remained the same size and was rather softer. Thereafter all symptoms and signs rapidly went and the spleen could not be felt on 6.4.43. He remained quite well until 22.4.43 when there was a fairly sudden onset of left facial

TEMPERATURE CHART. CASE 32.



paralysis without fever. The palsy was complete and of lower motor neurone type. Recovery began slowly on 1.5.43. At lumbar puncture on 5.5.43 a few c.c. of clear colourless fluid were withdrawn (Table I). Recovery of the paralysis was sustained and

TABLE I.—THE FINDINGS IN THE CEREBROSPINAL FLUID IN THE TWO CASES OF MENINGITIS AND ONE OF FACIAL PALSY IN WHICH THEY WERE ABNORMAL.

<i>Meningitis :</i> (M.)			W. B. C.									
Case	<i>or Facial Palsy :</i> (F.P.)	Pressure in mm. C.S.F.										
			Total	Polys. %	Lymphos. %	Glob.	Alb.	Sugar	Clot	Kahn	Date	
18	M.	Slightly +	50	12	88	++	+	Trace	Nil			27.8.42
		400+	26	15	85	Trace	+		Spider web			29.8.42
		150	11	9	91	+	+	+	Spider web	Neg.		3.9.42
22	M.	70	61	0	100	+	+		Nil			3.9.42
32	F.P.	Not +	20	*	*	Proteins 20 mgm.%		+	Nil			5.5.43
<div>Glob. + —</div> <div>Alb. + — = normal.</div> <div>Sugar + —</div> <div>* Laboratory unable to estimate.</div>												

almost complete by 16.6.43, when he was discharged to his unit. On 4.5.43 he began to have pot. iod. gr. xx t.d.s.; on 5.5.43 bismostab 0.2 gramme I.M. every seven days for six doses; and tryparsamide 1.5 grammes I.V. on 6.5.43 and 13.5.43, and 2.5 grammes on 20.5.43 and every seven days for four doses (total 13 grammes). This treatment was recommended for such cases by the Consultant Neurologist, M.E.F. Improvement began three days before treatment started.

The following notes are of cases which showed relatively unusual features in one way or another:

Case 4.—Indian, Sweeper, aged 25. Admitted to 82 G.H. on 25.5.42. There was sudden onset of fever on 21.5.42 with headache, pain in the back of the neck, joint and muscle pains, and severe pain in the right hypochondrium and epigastrium. On admission there were petechiæ on the trunk, his liver was enlarged 2 f. and very tender, there was considerable epigastric tenderness, and his spleen was enlarged and soft but not tender. For some days the patient passed tarry stools and there was vomiting but no hæmatemesis. Headache was severe. Fever lasting two days occurred every three to four days (total of three relapses) and blood films did not become positive until the third relapse. A blood count (Table II) was done on the first day of the third relapse when he was given sulphostab, 0.3 gramme I.V. He received 0.45 gramme and 0.6 gramme at five- and seven-day intervals. Discharged fit to unit on 25.6.42. There was no further fever.

Case 19.—Indian, Havildar, aged 35. Sudden onset of fever on 29.7.42, with considerable malaise, chill and vomiting. Admitted to another hospital on 1.8.42 and transferred to 82 G.H. on 10.8.42. For the next sixteen days his condition remained unchanged. He ran an irregular fever, never higher than 101° F., with periods of one to three days with no rise of temperature. He felt ill during this time and complained of a pain in the left hypochondrium which had started shortly before the original fever.

TABLE II.—WHITE BLOOD CELL COUNTS IN CASES WHERE THEY WERE PERFORMED

Case	Date	Febrile Treated (F.) (T.) or or Afebrile Untreated		Differential W.B.C. count (%)							Meta- myelo- Myelo- Plasma cytes cytes cells		
		(A.F.)	(U.T.)	W.B.C.	Polys.	Lymphos.	Monos.	Basos.	Eos.				
2	20.5.42	F.	U.T.	8,800	12	60	20		8				
3	21.5.42	A.F.	U.T.	9,000	46	48	6						
4	6.6.42	F.	U.T.	7,000									
6	30.5.42	F.	U.T.	8,000	73	25	2						
7	27.5.42	F.	U.T.	7,800	78	18	4						
9	2.6.42	F.	T.	9,000	54	44			2				
18	30.7.42	F.	U.T.	8,000	60	35	2				2	1	
	31.7.42	A.F.	U.T.	9,800	48	48.5	3		0.5				
	2.8.42	A.F.	U.T.	7,800	60	38	1				1		
19	13.8.42	A.F.	U.T.	10,000	72	27	1						
27	26.11.42	F.	U.T.	9,800	79	17	2	1	1				
33	16.3.43	A.F.	T.	17,200	66	23	6		5				
34	17.3.43	A.F.	T.	10,000	60	31	4		5				
	24.3.43	A.F.	T.	12,000	62.6	24.7	5.7	1.0	5.7				0.3

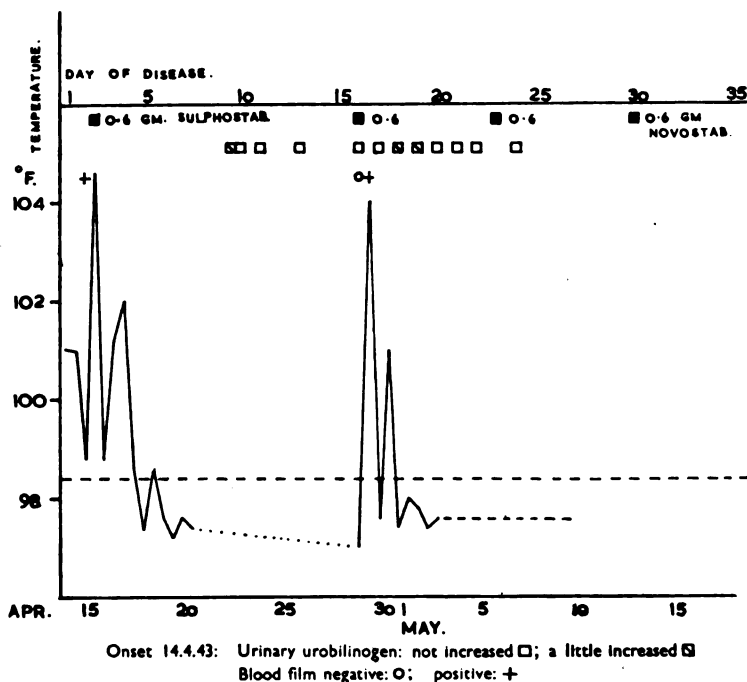
There was a loose cough with purulent sputum and much recent loss of weight. There were mild signs of bronchitis and the spleen was enlarged and soft. A W.B.C. count was normal (Table II). Periodic blood films and sputa examinations were negative and an X-ray of the chest showed normal lung fields. On 26.8.42 there was a sudden rise of temperature to 103° with increased malaise, chill and considerable vomiting. He looked ill. A blood film showed spirochaetes and he was given 0.6 gramme novostab. I.V. The next day he felt very much better and the fever rapidly subsided, but he complained of a persistent pain in the left knee and calf, with mild tenderness in these parts. On 3.9.42 the spleen was smaller but still mildly painful and tender. Discharged to Con. Dep. on 4.9.42. He was seen again on 25.9.42 when he had put on much weight and appeared quite fit. There was no further fever.

Case 35.—U.K., Driver, aged 33. He awoke on 14.4.43 "feeling like the morning after." Later he felt weak, began to shiver, developed a very severe headache and became very thirsty. He was admitted to another hospital the same day (*see chart*). The next day a positive blood film was obtained and he was given 0.6 gramme sulphostab, I.V. He had a severe general headache for three days during which time he felt very ill, couldn't sleep and had a persistent bizarre sensation "as though there were two of me." On 18.4.43 his fundi were normal. Transferred without symptoms or signs to 82 G.H. on 22.4.43.

A single relapse occurred on 29.4.43 with malaise and headache. His head was "going round" but there was no true vertigo. Novostab, 0.6 gramme I.V. was given at noon when a blood film was negative; one hour later there were relatively numerous spirochaetes in a blood film. During the night he vomited about twelve times with some gripping abdominal pain. For the first time there was mild lower and moderate upper abdominal tenderness. Vomiting continued all day with severe general headache (30.4.43) and he became fairly ill. He was restless, had a flushed face, couldn't sleep and again had the bizarre sensation previously mentioned. There was mild neck stiffness. He passed a good night after being given morphine and was very much improved the next day.

Thereafter there was rapid improvement in every way. He was given novostab, 0.6 gramme I.V. on 6.5.43 and on 13.5.43. Discharged to Con. Dep. on 17.5.43 and to unit on 3.6.43. There was no further fever.

TEMPERATURE CHART. CASE 35.



The following is a summary of the symptoms and signs recorded in the present series of 35 cases. Absolute numbers are given, with percentages in brackets. The figures and remarks in square brackets refer to the 12 Cyprus cases reported by Wood and Dixon (1945):

General and Unclassified Symptoms and Signs

Maximum number of relapses, 7 [4]; cases with no relapses, 2 [2]; duration of attacks, 1–8 days [1–3]; intervals between attacks, treated and untreated, 1–39 days [1–38]; headache, 22 (62.8 per cent) [11 (91.5 per cent)]; vomiting, 11 (31.4 per cent); nausea alone, 4 (11.4 per cent) [1 (8.4 per cent)]; constipation, 5 (14.3 per cent); shivering, 21 (60 per cent) [8 (66.6 per cent)]; sweating, 1 (2.9 per cent) [1 (8.4 per cent)]; feeling of coldness, 2 (5.7 per cent); malaise, 10 (28.6 per cent) [3 (25 per cent)]; anorexia (in fever), 5 (14.3 per cent) [1 (8.4 per cent)]; tiredness, 2 (5.7 per cent); weakness, 9 (25.7 per cent); insomnia, 4 (11.4 per cent); palpitation, 1 (2.9 per cent); “hangover,” 1 (2.9 per cent); thirst, 1 (2.9 per cent); sense of “duality” (Case 35), 1 (2.9 per cent); giddiness, 1 (2.9 per cent) [2 (16.7 per cent)]; petechiæ, 2 (5.7 per cent); melaena, 1 (2.9 per cent); face flushed, 2 (5.7 per cent); loss of weight, 5 (14.3 per cent); anæmia, 2 (5.7 per cent); leucocytosis, 2 (of 11 examined) (Table II); herpes simplex, 1 (2.9 per cent) [1 (8.4 per cent)]; prolonged irregular fever, 1 (2.9 per cent) [2 (16.7 per cent)]; aching behind eyes

[2 (16·7 per cent)]; blood Kahn reaction, one doubtful in 4 tests [11 tests all negative]. In many cases succeeding relapses, if uncomplicated, tended to become shorter and less severe.

Abdominal Symptoms and Signs

Loin pain, 2 (5·7 per cent); epigastric pain, 5 (14·3 per cent); right hypochondrium pain, 4 (11·4 per cent); left hypochondrium pain, 3 (8·6 per cent); vague general abdominal pain, 4 (11·4 per cent); R.I.F. pain, 1 (2·9 per cent); "tight, uneasy" abdomen, 1 (2·9 per cent); abdominal colic, 1 (2·9 per cent); spleen enlarged, 21 (60 per cent); spleen tender, 8 (22·9 per cent); liver enlarged, 5 (14·3 per cent); liver tender, 14 (40 per cent); increased urinary urobilin or urobilinogen, 7 (11 tested) [6 (7 tested)]; epigastric tenderness, 8 (22·9 per cent); R.I.F. tenderness, 2 (5·7 per cent); umbilical tenderness, 1 (2·9 per cent); diarrhoea, 2 (5·7 per cent); mucus in stools, 2 (5·7 per cent); blood in stools, 1 (2·9 per cent); jaundice [1 (8·4 per cent)]; urine: some cases had mild albuminuria during pyrexia.

Joint and Muscle Symptoms and Signs

Backache, 11 (31·4 per cent) [3 (25 per cent)]; pain at back of neck, 7 (20 per cent); general aches and pains, 18 (51·5 per cent); stiff back, 1 (2·9 per cent); vague chest pain, 6 (17·1 per cent); joint effusions, 1 (2·9 per cent); tender muscles, 5 (14·3 per cent); tender rib, 1 (2·9 per cent); pains in shoulders [1 (8·4 per cent)]; pains in limbs [1 (8·4 per cent)].

Respiratory Tract Symptoms and Signs

Coryza, 2 (5·7 per cent); sore throat, 1 (2·9 per cent); cough, 6 (17·1 per cent); sputum, 4 (11·4 per cent); difficulty in breathing, 1 (2·9 per cent); lung rhonchi, 4 (11·4 per cent).

Neurological and Ocular Complications

Meningitis, 3 (8·6 per cent) [4 (33·3 per cent)]; facial palsy, 2 (5·7 per cent); encephalitis, 1 (2·9 per cent); papilloedema, 4 (11·4 per cent) [5 (41·5 per cent)]; choroiditis [1 (8·4 per cent)]; weakness of ocular accommodation [1 (8·4 per cent)]; deterioration of vision, 1 (2·9 per cent).

Total cases with neurological complications, 6 (17·1 per cent) [4 (33 per cent)].

Symptoms and Signs Present with Neurological Complications

Headache, 4; vomiting, 1; painful eye movements, 1; drowsy or lethargic, 2; neck rigidity, 3; knee-jerks sluggish, 4; ankle-jerks sluggish, 1; arm-jerks absent, 1; abdominal reflexes sluggish, 1; restlessness, 1; abnormal c.s.f., 3 [4] (Table IV).

Other Points

Incubation period, 7–15 days [8–10]; effect of organic arsenicals in treatment, poor [poor]; period of incapacity, 13–131 days [20–111]; spirochaetes in peripheral blood, nearly always scanty, never profuse.

Complicating Diseases

Malaria, benign tertian, 2. Malaria, malignant tertian, 3. Gonorrhœa, 1. Chronic rheumatic heart disease with mitral stenosis, 2. Urticaria, 1. Chronic irido-cyclitis, 1.

The commonest manifestations met with in this series were:

	<i>Per cent</i>		<i>Per cent</i>
Headache	62·8	Pain at back of neck	20·0
Shivering	60·0	Vague chest pain	17·1
Splenic enlargement		Cough	
General aches and pains	51·5	Anorexia	14·3
Liver tenderness	40·0	Loss of weight	
Vomiting	31·4	Constipation	
Backache		Epigastric pain	
Malaise	28·6	Liver enlargement	14·3
Weakness	25·7	Tender muscles	
Splenic	22·9	Increase of urinary	urobilin 7 of 11 cases
Epigastric } tenderness			

COMPARISON OF THE CLINICAL MANIFESTATIONS OF TICK- AND LOUSE-BORNE
RELAPSING FEVERS

The purpose of this discussion is partly to amplify the findings so far reported and partly to examine the possibilities of a clinical differentiation of the two forms of the disease. Few accounts of relapsing fever attempt such a formulation except on a somewhat superficial plane. This analysis makes no attempt to be comprehensive and is referred chiefly to what was found in our cases. Examination of the literature reveals that there are not a great many instances of writers giving detailed attention to the clinical aspect of the condition and all too often reliable evidence as to the vector is lacking. The need for investigation into the nature of the transmitting agent has been stressed by Coghill and Gambles (1948). For this, guinea-pig inoculation and search for the vector in the field are essential.

In only eight of the papers quoted in the following discussion were the vectors known with complete or almost complete certainty. In all the other papers consulted varying degrees of evidence are available by which it might be possible to adduce the transmitting agent. Many articles in which it is impossible to decide what the vector might be have had to be ignored. For the purposes of tabulation the letters "T" and "L" are applied after the papers quoted, to signify "Tick-borne" or "Louse-borne." Unqualified letters are used only after the eight papers noted above. Where the vector is less certainly proved, but where there is reasonable probability, "?T" and "?L" are used, and where there is greater uncertainty "??T" and "??L." In the last two categories it is difficult to judge degrees of certainty without begging the question and only a few points such as site, season and incidence of infection, can sometimes be used for differentiation. This is far from being a satisfactory basis for an attempt to classify clinical manifestations, additionally so as some of the outbreaks recorded may have contained cases of both types. However, even a tentative effort in this direction may help to put the diseases on a firmer clinical footing.

General and Other Symptoms and Signs

Maximum number of relapses.—A perusal of the literature reveals what is generally appreciated, that more relapse may be expected with the tick-borne (T-B) form. More than 4 are very rarely seen with the louse-borne (L-B) type where one or two are the usual maxima. 3 or more are common if not usual with the former and the maximum recorded appears to be 20 by Kassirsky (1933) (?T). 17 are reported by Bulmer (1943) (?T), 13 by Adler *et al.* (1937) (T), 12 by Briggs (1935) (?T), 11 by Manson and Thornton (1919) (?T) and Lawrence and Terrell (1942) (T), 9 by Cooper (1942) (?T). In our series the maximum recorded was 7 in one patient, and for the rest one had 6, one 5, three 4, five 3, nine 2, thirteen 1 and two had none. However, all these were treated for the most part relatively early in the disease. The figures for relapses before treatment are: one had 4, two had 3, eight had 2, fourteen had 1 and ten had none.

Absence of relapses, treated or untreated, is much commoner in the L-B form. This may be a point of importance in diagnosis, especially at the onset of an epidemic.

Duration of attacks.—Untreated these are generally longer with the L-B type, varying from two to ten days in different series, and treatment appears to exert more effect in lowering the temperature. The paroxysms, treated or untreated, are usually briefer with the other form and vary from as few as three hours to five or seven days. Occasionally *prolonged irregular fever* is noted in T-B cases. This may last up to one month, be almost typhoid-like, remittent-intermittent or grossly irregular in which case the fever may not necessarily be high. Examples of the first are mentioned by Ordman and Jones (1940) (?T) and Marques (1944) (?T); of the second by Adler *et al.* (1937) (T) and Coghill *et al.* (1947) (?T); and of the third by Drake-Brockman (1914) (?T), Harold (1920) (?T) and Wood and Dixon (1945) (T). Our Case 19 belongs to the last group. These types of prolonged fever are an interesting manifestation and contrast with the classical fever of the disease, leading to much difficulty in diagnosis. They seldom occur in L-B relapsing fever although Chung and Chang (1939) (?L) noted irregular pyrexia sometimes in children.

Headache is a very common symptom and equally frequent in both forms of the disease.

Vomiting appears to be relatively uncommon in most reports of T-B relapsing fever in the absence of meningitis, although it occurred in 31 per cent of cases in the present series and Ross and Milne (1904) (?T) describe it as a prominent symptom and Briggs (1935) (?T) records it in 74 per cent of his 53 cases. In the other conditions vomiting is reported up to high percentages by Sinton (1921) (?L), Selwyn-Clarke *et al.* (1923) (?L), Beveridge (1928) (?L), Chung and Chang (1939) (?L) and Benhamou *et al.* (1946) (?L). *Nausea* alone is occasionally noted in both forms.

Constipation is recorded by some observers as a notable symptom, perhaps more common in the L-B cases. McCulloch (1925) (?L) found it in 79 per cent of 300 cases and Chung and Chang (1939) (?L) in 47 per cent of 337.

Shivering (rigor) with the onset of the paroxysm seems to be a variable symptom. Its rarity or absence is specifically noted by some authors—Browse (1912) (?T) and Newcomb (1920) (?L). It is a common symptom in many series.

Sweating of an especially profuse nature has been commented on by some authors, notably Briggs (1935) (T) (82 per cent of 53 cases), Chung and Chang (1939) (L) (27 per cent of 337 cases) and Cooper (1942) (T) (62 per cent of 63 cases).

Malaise is specifically mentioned by only a few authors. However, there is no doubt that during the paroxysm many patients feel very ill.

Tiredness, weakness and debility are mentioned as being notable only in the T-B type. They are symptoms which may be related to the length of the illness.

Insomnia is a symptom not often noted. It is mentioned by Sinton (1921) (L), Magee (1942) (T) and Cooper (1942) (T) (11 per cent).

Giddiness has been reported from time to time, mostly in the T-B form. It was common in the cases of Selwyn-Clarke *et al.* (1923) (L) and the incidence in Cooper's (1942) (T) series was 24 per cent. The single complaint of giddiness recorded in the present author's cases was in an Englishman and it was not a true vertigo. "Giddiness" is a usual complaint by Indians when ill from any cause.

Hæmorrhage.—A variety of types of bleeding, usually infrequent, are recorded in the literature, most kinds being much commoner in L-B than in T-B relapsing fever. *Epistaxis* is the commonest hæmorrhagic manifestation and is recorded among others by Manson and Thornton (1919) (TT) (4 in 1,500 cases), Sinton (1921) (L) (29 per cent of 31 cases), McCulloch (1925) (L) (17 per cent of over 300 cases), Chung and Chang (1939) (L) (27 per cent), Ordman and Jones (1940) (T) (frequently in 1,800 cases) and Robinson (1942) (L) (12 per cent of 340 cases). *Hæmatemesis* is not often mentioned; Medulla (1934) (T) had one case in a small series of 4, and Chung and Chang (1939) (L) noted it in 0.3 per cent of their series of 337. *Melæna* is only rarely recorded; it occurred in 1.5 per cent of the last mentioned series but these authors occasionally noted frank *red blood in the stools* of other patients, a manifestation also noted by Wright and Harold (1920) (TT), Ordman and Jones (1940) (T) and Marques (1944) (TT). *Hæmoptysis* is rare; Charters (1942) (L) had one instance in 32 cases, and it was also seen by Wright and Harold (1920) (TT) and Roy (1921) (TL). *Hæmorrhage from and into mucous membranes (gums, conjunctivæ, etc.)* is uncommon but is noted by Manson and Thornton (1919) (TT), Sinton (1921) (L), Ordman and Jones (1940) (T) and Robinson (1942) (L) (12 per cent). *Petechiæ* are a little more commonly reported, notably by Briggs (1935) (T) (4 per cent), Chung and Chang (1939) (L) (35 per cent), Robinson (1942) (L) (8 per cent) and Cooper (1942) (T) (8 per cent). Occasional echymoses were recorded by Lebert (1875) (L). Speaking of T-B relapsing fever Rogers and Megaw (1944) state that the "rash may be hæmorrhagic in severe cases." No rash other than petechiæ was observed in any of our cases (admittedly most were dark-skinned) and those with petechiæ

were not severe cases. *Hæmaturia* has been recorded a few times, notably by Chung and Chang (1939) (?L) (11 per cent), but in most cases the blood is only found on microscopical examination of the urine and frank hæmaturia must be rare; it has been seen coming from the bladder by Manson and Thornton (1919) (??T). *Uterine hæmorrhage* is recorded as a rare event by Lebert (1875) (?L). *Subarachnoid hæmorrhage* was found in one case by Dewar and Walmsley (1945) (?T) and unspecified *cerebral hæmorrhage* is mentioned by Robinson (1942) (?L) and Manson and Thornton (1919) (??T). Occasionally one case may show numerous bleeding manifestations; such a patient is that of Dewar and Walmsley (1945) (?T). Benhamou *et al.* (1946) (?L) report many different kinds of hæmorrhage among their 3,800 cases.

Little appears to have been done to determine the cause of hæmorrhage in relapsing fever. Aggregations of spirochætes in the capillaries was a theory put forward by Manson and Thornton (1919) (??T) and Charters (1942) (?L) to explain the focal manifestations of relapsing fever (compare malignant tertian malaria). Wail (1922) found evidence of capillary endothelium damage of a specific nature. Adler and Ashbel (1937) (T) postulate capillary damage due to spirochætes escaping through capillary walls, a phenomenon they have observed. One author (Robinson (1942) (?L)) found that the prothrombin time was increased in all the cases tested (probably from liver damage), and that vitamin K helped to stop hæmorrhage.

Flushing of the face, noted in two of our cases does not appear to be a usual sign and no reference to it has been found in the papers consulted. *Pallor of the skin* was remarked on by Cooper (1942) (?T).

Loss of weight is a manifestation noted by few, but is commented on by the following, some of whom remark on it as a striking effect of the disease: Harold (1920) (??T), Beveridge (1928) (?L), Medulla (1934 and 1935) (?T) (3 of 7 cases), Cooper (1942) (?T) (28.5 per cent) and Magee (1942) (?T).

Anæmia appears to be rare, and almost never severe. Most references to it concern cases which are possibly or probably T-B; this may be fortuitous, but if not is probably due to the greater length of this illness. Anæmia is mentioned as occurring sometimes by Lebert (1875) (?L), McCulloch (1925) (?L) and Briggs (1935) (?T); as occurring occasionally by Browse (1912) (??T), Adler *et al.* (1937) (T) and Chung and Chang (1939) (?L). Calwell (1920) (??T) states that he found anæmia frequently in cases in Palestine.

Leucocytosis is recorded by some authors, usually during the fever. On the whole it seems commoner in the L-B than the T-B form. Sawtschenko and Melkich (1901) (?L), Manson and Thornton (1919) (??T); Sachs (1934) (??T), Briggs (1935) (?T) and Adler *et al.* (1937) (T) found it in some of their cases, usually slight. Calwell (1920) (??T), Sinton (1921) (?L), McCulloch (1925) (?L) and Lawrence and Terrell (1942) (T) report it as fairly common, while Chung and Chang (1939) (?L) found it in 60 per cent of their series. Respiratory complications, if marked, cause an increased leucocytosis according to Manson and Thornton, 1919 (??T) and Chung and Chang (1939) (?L). In our series the blood leucocyte counts showed nothing very unusual. Two had a moderate monocytosis which is considered a fairly common finding in re-

lapsing fever. (Manson and Thornton, 1919 (??T)); Calwell, 1920 (??T); Sinton, 1921 (?L); McCulloch, 1925 (?L); Lawrence and Terrell, 1942 (T).

Herpes simplex (usually *labialis*) is not often remarked on in the literature and seems less common than in malaria or pneumonia. It occurred in 3.9 per cent of Chung and Chang's (1939) (?L) cases, was recorded once by Drake-Brockman (1914) (?T) and occasionally by Dutton and Todd (1905*b*) (?T) and Sergeant (1938) (T). However Briggs (1935) (?T) noted it in 14 per cent of 53 cases. It seems more common in T-B than in L-B relapsing fever.

Succeeding relapses have been found by some to become milder and shorter. (Briggs, 1935 (?T) and Magee, 1942 (?T)). This was also recorded by Kemp *et al.* (1935) (?T) in some cases although in others the earlier succeeding relapses became more severe.

Sense of Duality.—Our patient (Case 35) had the bizarre feeling that there were "two of him" during the initial attack and again in the single relapse he sustained. The patient was an intelligent witness but found difficulty in adequate description of the symptom. Marques (1944) (??T), among others, has noted what he terms "*complex psyche phenomena*."

Abdominal Symptoms and Signs

We found abdominal pain and especially tenderness fairly commonly in one situation or another, particularly over liver and spleen. Many others have recorded somewhat similar findings.

Pain or pressure in the epigastrium was noted by Beveridge (1928) (?L) occasionally, by Medulla (1934) (?T) in 3 or 4 cases, by Burns (1936) (?T) in 1 case, by Adler *et al.* (1937) (T) in 1 of 45 cases, by Chung and Chang (1939) (?L) in 9.5 per cent of cases, frequently by Magee (1942) (?T) and often by Benhamou *et al.* (1946) (?L).

Splenic pain has been reported as an occasional occurrence by Manson and Thornton (1919) (??T), Wright and Harold (1920) (??T) and Sinton (1921) (?L); in 3 of 45 cases by Bergsma (1929) (??L); and as a fairly frequent manifestation by Ordman and Jones (1940) (?T).

Hepatic pain was recorded relatively often by Lebert (1875) (?L), Manson and Thornton (1919) (??T), Calwell (1920) (??T) and Sinton (1921) (?L).

Loin pain was noted by Cooper (1942) (?T) in 11 per cent of cases.

General abdominal pain has been reported by Lebert (1875) (?L) and Marques (1944) (??T), in 19 per cent of cases by Chung and Chang (1939) (?L), in 33 per cent of cases by Cooper (1942) (?T) and by Dewar and Walmsley (1945) (?T) in their single case.

Abdominal rigidity was noted sometimes by Charters (1942) (?L). In our Case 18 where abdominal pain was conspicuous there was no increase in abdominal wall resistance.

Epigastric Tenderness.—In our cases this may sometimes have been no more than an extension of the liver tenderness; in only one was it limited to the epigastrium. This sign was occasionally found in the series of Beveridge (1928) (?L).

General abdominal tenderness has been reported by Roy (1921) (??L), Sergeant *et al.* (1933) (T) and Cooper (1942) (?T) (11 per cent of cases).

Iliac fossa tenderness was noted in one case by Coghill *et al.* (1947) (?T).

Although different series vary greatly in the incidence of the above symptoms and signs it seems likely that they occur about as frequently in L-B as in T-B relapsing fever, and they are sometimes common. Delamare (1930) has drawn particular attention to these features of the disease but unfortunately does not state to which type he is referring. He describes a patient rather similar to our *Case 18*, who presented as a surgical emergency and whose abdomen was opened for appendicectomy.

These abdominal manifestations are mentioned, but not enlarged upon, by Rogers and Megaw (1944), Manson-Bahr (1945), Strong (1945) and Fairley (1946).

Splenic Tenderness.—This is recorded by many authors and is a common finding, although its incidence appears to vary widely. It was sometimes found by Kemp *et al.* (1935) (?T), often by Drake-Brockman (1914) (?T), Sinton (1921) (?L) and Ordman and Jones (1940) (?T), and in 3 of 18 cases by Browse (1912) (??T), in 13 per cent of cases by McCulloch (1925) (?L), in 20 per cent by Bergsma (1929) (??L), in 6 of 337 by Chung and Chang (1939) (?L), in 41 per cent of 32 by Charters (1942) (?L), in 17 per cent by Cooper (1942) (?T) and in 44 per cent by Robinson (1942) (?L).

Splenic Enlargement.—This is reported by many; good examples are Lebert (1875) (?L) (often), Dutton and Todd (1905a) (?T) (fairly often), Newcombe (1920) (??L) and Sinton (1921) (?L) (each 30 per cent of cases), Mackie (1927) (??T) (often), Beveridge (1928) (?L) (52 per cent), Briggs (1935) (?T) (33 per cent), Chung and Chang (1939) (?L) (69 per cent), Cooper (1942) (?T) (30 per cent), Robinson (1942) (?L) (89 per cent), Charters (1942) (?L) (59.5 per cent), Bulmer (1943) (?T) (usual) and Marques (1944) (??T) (71 per cent). Considerable variation is seen in different series of cases. Marzinowsky (1927) comparing European (probably L-B) relapsing fever with Persian (presumably T-B) stated that the spleen is enlarged and easily palpable in the former but very hard and not always felt in the latter.

Among our own cases 60 per cent had mildly enlarged spleens; of these all but two were Indians and one of the remainder was a Cypriot. Splenic enlargement due to chronic malaria, however, is not as common as this among Indian adults, and under observation many of these spleens were softer than would have been expected if they were malarial, and the enlargement frequently diminished or disappeared along with the tenderness, in convalescence.

Perisplenitis and *splenic infarcts* are mentioned by Ordman and Jones (1940) (?T), Robinson (1942) (?L) and Lebert (1875) (?L) (infarcts only) as uncommon findings.

Liver tenderness has been noted among others by Lebert (1875) (?L) (often), Drake-Brockman (1914) (?T) (often), Manson and Thornton (1919) (??T) (sometimes), Sinton (1921) (?L) (often), Beveridge (1928) (?L) (2 per cent of cases), Katz (1930) (??T) (all of 38 cases), Chung and Chang (1939) (?L) (several cases), Cooper (1942) (?T) (79 per cent) and Charters (1942) (?L) (72 per cent).

Liver enlargement has been recorded by many; chief examples are: Lebert (1875) (?L) (often), Drake-Brockman (1914) (?T) (often), Manson and Thornton (1919) (??T) (often), Sinton (1921) (?L) (93.5 per cent), Beveridge (1928) (?L) (44 per cent), Kemp *et al.* (1935) (?T) (sometimes), Briggs (1935) (?T) (14 per cent), Chung and Chang (1939) (?L) (41 per cent), Ordman and Jones (1940) (?T) (sometimes), Charters (1942) (?L) (72 per cent), Cooper (1942) (?T) (13 per cent) and Lawrence and Terrell (1942) (T) (sometimes). Others have noted that as with the spleen the enlargement may diminish during the apyrexial periods (Benhamou *et al.*, 1946 (?L)).

Jaundice is an important manifestation which is fairly common. It has been reported principally by Manson and Thornton (1919) (??T) (sometimes), Calwell (1920) (??T) (slight in 25 per cent, severe in one), Wright and Harold (1920) (??T) (up to 5 per cent), Sinton (1921) (?L) (48 per cent), McCulloch (1925) (?L) (about 80 per cent), Beveridge (1928) (?L) (20 per cent), Briggs (1935) (?T) (18 per cent), Chung and Chang (1939) (?L) (29 per cent), Ordman and Jones (1940) (?T) (sometimes), Robinson (1942) (?L) (72 per cent), Charters (1942) (?L) (16 per cent), Cooper (1942) (?T) (10 per cent) and Benhamou *et al.* (1946) (?L) (about two-thirds of 3,800 cases).

Taking the hepatic and splenic signs together it appears probable that liver tenderness, enlargement and jaundice are rather commoner in L-B than T-B relapsing fever, but that splenic tenderness and enlargement are about equal in the two forms. However, the work of Russell (1932) in the Gold Coast on what must have been L-B relapsing fever, and evidence she brings forward from the literature, makes it probable that splenic lesions in this type may be more severe than those usually found in the T-B form. As long ago as 1875 Lebert (?L), quoting others, described severe changes in the spleen similar to those found by Russell. There is less frequent opportunity to examine the spleens *post-mortem* in T-B relapsing fever with its lower mortality so that material is not as plentiful in this form. However Manson and Thornton (1919) (??T) did find almost completely necrotic spleens at autopsy. This compares with Ordman and Jones (1940) (?T) who described only a surface fibrinous splenic exudate, and Dewar and Walmsley (1945) (?T) who discovered little evidence of disease in the spleen of their single mortal case.

In our own series of cases liver enlargement was found in 14 per cent. This agrees well with the incidence of this sign usually found in T-B relapsing fever and contrasts with that in the L-B type where it is often much higher. None of our cases became jaundiced although from the testimony of Mr. Mogabgab (quoted by Gambles and Coghill, 1948) relapsing fever in Cyprus, if untreated, may give rise to this manifestation, and one of Wood and Dixon's (1945) (T) cases developed slight icterus.

Diarrhœa is sometimes a frequent finding but is often rare or absent. When present it often occurs with the crisis. It was noted by Ross and Milne (1904) (?T) and is otherwise mentioned chiefly by Calwell (1920) (??T) (occasionally), McCulloch (1925) (?L) (21 per cent), Beveridge (1928) (?L) (47 per cent), Chung and Chang (1939) (?L) (14 per cent) and Cooper (1942) (?T) (11 per cent). It appears to be commoner in the L-B type. The presence of excess *mucus in*

the stools has been reported once by Adler *et al.* (1937) (T) and as occurring sometimes by Ordman and Jones (1940) (?T) and Marques (1944) (??T).

Urinary Urobilin (or Urobilinogen).—Coskinas (1914) (??L) was the first to describe in relapsing fever an increase in the urinary urobilin, without the presence of bile pigments or salts. Lafforgue (1914) (??T) confirmed this finding in cases in Tunis. In some of our cases the urine was tested for an increase in urobilin and/or urobilinogen when Dixon (1943) (T) communicated his results to us.

The test used for urobilin was Schlesinger's, with alcoholic zinc acetate; that for urobilinogen was with Ehrlich's reagent (p-dimethylaminobenzaldehyde). In all cases the urine was obtained during the late morning or in the afternoon, and was tested immediately after voiding in the case of urobilinogen, or after standing some hours in daylight or sunlight for urobilin. In the Ehrlich test the urine was diluted one in ten before addition of the reagent. This was found to be the best test. Used according to the method of Stitt *et al.* (1938) it is capable of a greater degree of quantitative accuracy than is Schlesinger's test. The greater number of negatives among our cases compared with those of Wood and Dixon (1945) (T) and Dixon (1943) (T) is accounted for by the fact that the first cases we tested were at a late stage in their illness. The urinary increase of urobilin may not occur with each attack as Dixon found. It may occur during an apyrexial period; but this is so uncommon that the test cannot be used to forecast a relapse.

The presence of urobilin in the urine in greater amounts than normal was presumed by Dixon (1943) (T) to indicate some degree of liver damage. Although in the occasional case there seemed to be some relation between the presence and degree of hepatic tenderness and enlargement, and the quantities of urobilin in the urine, generally speaking no constant correlation could be made out (*see Temperature Charts*). It must not be forgotten that an increase in urinary urobilin is common during fevers and may be considerable although short-lived in conditions such as sandfly fever and especially malaria. In these, however, the increase is related to the fever. The fact that in relapsing fever it may (rarely) not be so might be taken as additional evidence of liver damage by the spirochætes.

Although such manifestations as hepatic pain, tenderness and enlargement, jaundice and urobilinuria point to the presence of liver damage in this disease there are not often convincing records of its presence, degree or nature. Manson and Thornton (1919) (??T) speak of the liver at *post-mortem* as considerably enlarged, soft and showing "a marked degree of early toxic change." Kennedy (1920) describes the findings in two fatal cases (no evidence as to vector). He found, among other things, great destruction of the liver cells, more in the central part of the lobule than the periphery. Ordman and Jones (1940) (?T) make no mention of the liver in discussing their autopsy material. In the well-described severe case of Dewar and Walmsley (1945) (?T) histological evidence of liver damage was slight.

Using these tests for urobilin and urobilinogen in urine there was no evidence that in our cases any liver damage arose from the administration of arsenicals.

Joint and Muscle Symptoms and Signs

Backache and back pains may be prominent symptoms which are recorded by a number of writers, including Lebert (1875) (?L), Drake-Brockman (1914) (?T), Manson and Thornton (1919) (??T), McCulloch (1925) (?L) (45 per cent), Kemp *et al.* (1935) (?T), Davis *et al.* (1941) (T), Cooper (1942) (?T) (44·5 per cent) and Magee (1942) (?T).

Chest pain is mentioned by Manson and Thornton (1919) (??T), Sinton (1921) (?L), Chung and Chang (1939) (?L) (5 per cent) and Cooper (1942) (?T) (11 per cent).

Painful and tender muscles were sometimes noted by Lebert (1875) (?L), Drake-Brockman (1914) (?T), Roy (1921) (??L) and Kassirsky (1933) (?T). In our cases the sternomastoids were most often affected. The tenderness was sometimes considerable and lasted continuously for several weeks. The pectoral muscles were affected in one.

Joint pains are less common than limb or body pains but have been noted with fair frequency in some series. Joint effusions were seen in one of our cases (knees) who, however, gave a history of previous attacks of rheumatic fever and who had mitral stenosis. In this instance it was difficult to be certain of the ætiology of the arthritis. Roy (1921) (??L) and Dixon (1943) (T) each describe a case with joint effusions apparently due to relapsing fever.

All the manifestations in this category have probably much the same incidence in both forms of relapsing fever.

Respiratory Tract Symptoms and Signs

It is possible that these would be better termed "complications." In our own series it is difficult to know how much attention should be paid to them. The lung signs were not a striking feature as they have been in some series and were usually no more than are commonly met with in sandfly fever, malaria and typhoid, during the febrile period. Pulmonary complications such as dyspnœa, lobar or bronchopneumonia, and pleurisy seem relatively unusual and to be found equally with the L-B or T-B forms. However, a cough, presumably indicative of a mild acute bronchitis, has been found in considerable numbers in some series. Calwell (1920) (??L) noted it in 14·5 per cent of 69 cases in Egypt, Wright and Harold (1920) (?T) in 68 per cent, Roy (1921) (??L) in 50 per cent, Chung and Chang (1939) (?L) in 41 per cent and Cooper (1942) (?T) in 21 per cent. The incidence of lobar pneumonia has been of the order of 3 in 337 cases of Chung and Chang (1939) (?L) and 4 in 63 cases of Cooper (1942) (?T): and bronchopneumonia was seen in many cases of Lagrange (1927) (??T) and in 5 per cent of cases of Chung and Chang (1939) (?L). Dyspnœa is sometimes a notable feature and may be severe.

Neurological Complications

These, of which there is a considerable variety, are nearly always met with much more commonly in the T-B disease. Their incidence in any unselected group of cases is usually low. As Scott (1944) (?T) points out, however, certain localities may give rise to greater numbers, for example about 20 per cent in

cases from the Egyptian western desert and around Tobruk. Taking our cases with those of Wood and Dixon (1945) (T) there were 10 with neurological complications among a total of 47 which gives an incidence in Cyprus of 21 per cent. This figure is probably unwarrantably high through partial selection. They may appear at any time in the course of the illness up to eight weeks or more from the onset (Cooper, 1942 (?T) and Scott, 1944 (?T)) and are often late (Manson and Thornton, 1919 (??T)). Of the two commonest manifestations meningitis normally appears earlier than cranial nerve lesions.

Meningitis.—Early accounts of this complication are given by Coskinas (1914) and Ardin-Delteil *et al.* (1914), the former possibly L-B and the latter possibly T-B. It was seen in a "fair proportion" of cases by Bulmer (1943) (?T), in one case by Chung and Chang (1939) (?L), in at least 3 of about 40 cases by Hawking (1941) (?T), in 5 out of 5 patients by Sautet (1941) (T), in one by Magee (1942) (?T), in 7 of 63 by Cooper (1942) (?T), in a few cases by Benhamou *et al.* (1946) (?L), and in 2 of 4 by Coghill *et al.* (1947) (?T). Collected cases are reported by Scott (1944) (?T) and McAlpine (1946) (?T). "Pachymeningitis" is recorded by Lebert (1875) (?L) in a few cases, and by Robinson (1942) (?L) in 3 of 340 cases. Scott (1944) (?T) and others (Consultant in Tropical Medicine, M.E.F., 1943a (?T)) found meningitis might recur persistently. Such a course of the illness, although by no means infrequent is not a general rule in the Middle East or elsewhere as has been suggested by McAlpine (1946) (?T).

There is nearly always a leucocytic pleocytosis in the c.s.f. which, however, seldom rises above 2,000 per c.mm., the majority of the cells being lymphocytes. Hawking (1941) (?T) found a mild increase in W.B.C. in the c.s.f. of 2 cases who had no clinical signs of meningitis and in 1 of whom spirochaetes were demonstrated in the c.s.f. Chung (1938) (?L) examined the c.s.f. of 26 patients and found a mild increase in cells (mostly lymphocytes) in some, but did not state if there was any clinical evidence of meningitis in these cases. The c.s.f. pressure is often increased and the protein variably so. The c.s.f. *Wassermann reaction* is sometimes positive as reported by Chung (1938) (?L) and others (Consultant Neurologist, M.E.F., 1942 (?T)).

Spirochaetes have been found in the c.s.f. from time to time, either by microscopy or animal inoculation. Such findings have been described by Soulié (1907) (??T), Hawking (1941) (?T) and Chung (1938) (?L) who quotes a number of similar instances from the literature. The Consultant in Tropical Medicine, M.E.F. (1943a) (?T) recorded a case where spirochaetes were found by guinea-pig inoculation two months after the completion of very adequate treatment; and the Consultant Neurologist, M.E.F. (1942) (?T) a case where they were found in the c.s.f. although they were never seen in the peripheral blood.

The signs of meningitis recorded in the literature, apart from abnormal cerebrospinal fluid, are photophobia, headache, vomiting, neck rigidity and, much less commonly, a positive Kernig's sign. It is believed that headache may constitute the only sign of meningitis ("Notes on Nervous Diseases, etc., M.E.F.", 1943 (?T)).

In two of the three cases here reported there was recurrence or exacerbation of the meningitis. In *Case 18* the pressure was very high (over 400 mm. c.s.f.)

and in this patient papilloedema was marked and there was severe vomiting. One patient (*Case 25*) had clinical evidence of meningitis (severe headache, moderate neck stiffness, mild unilateral papilloedema) but a completely normal c.s.f. In two there was diminution in the strength, or absence, of the tendon reflexes during the course of the illness.

In view of what has been written about the neurotropism and multiplicity of different strains of spirochaetes it is interesting to record that our *Case 18* and Wood and Dixon's (1945) (T) *Case 10*, both of whom had meningitis, were infected at the same site.

Cranial nerve palsies are the next most common neurological complication, and occur chiefly in the T-B form. They have been recorded among others by Manson and Thornton (1919) (??T) ("very common"), Beveridge (1928) (?L) (2 per cent), Kemp *et al.* (1935) (?T) (2 in 258 cases), Medulla (1935) (?T) (2 in 3 cases), Ordman and Jones (1940) (?T) (few cases), Consultant in Tropical Medicine, M.E.F. (1942*a* and *b* and 1943*b*) (?T) (several cases), Cooper (1942) (?T) (7 in 63 cases) and Scott (1944) (?T) (collected cases). The most commonly affected nerve is the VIIth, usually unilaterally. Prosis and diplopia are reported by Manson and Thornton (1919) (??T), McCulloch (1925) (?L) (rare) and Scott (1944) (?T) (N.VI). Magee (1942) (?T) quotes a personal communication from Davis that permanent damage may result to the optic and auditory nerves, Rogers and Megaw (1944) state that facial paralysis may be permanent. In our 2 cases of facial palsy (lower motor neurone type) the onset was thirty-seven and seventy-four days respectively after the commencement of the relapsing fever. In one (*Case 32*) the c.s.f. thirteen days after the onset of the complication contained 20 W.B.C. per c.mm., but no other abnormality. One case recovered rapidly, perhaps hastened by treatment, the other showed no improvement over a period of observation of fifty-three days.

Neuritis (true peripheral), with pain, has been noted in both forms of the disease, but more often in the T-B variety, by Adler *et al.* (1937) (T), Magee (1942) (?T), Charters (1942) (?L), Cooper (1942) (?T) and Marques (1944) (??T).

Other, rare, neurological manifestations include *hemiparesis* and *monoplegias* (Ordman and Jones, 1940, and Scott, 1944); *stupor* (Lebert, 1875) (?L), (Bergsma, 1929 (??L) and Coghill *et al.* (1947) (?T)); *convulsions* (Chung and Chang, 1939 (?L)); *epileptiform state* (Marques, 1944 (??T)); *delirium* and *psychosis*, mostly in the L-B form; *aphasia* (Manson and Thornton, 1919 (??T)); *aphonia* (McCulloch, 1925 (?L)); *loss of sphincter control* (Ordman and Jones, 1940 (?T), and Magee, 1942 (?T)); *sensory changes* (Cooper, 1942 (?T)); *depression* (Dutton and Todd, 1905*a* (?T)); *radiculitis* (Magee, 1942 (?T)); *hiccough*, usually uncommon, but seen in about 9 per cent of cases by McCulloch. (1925) (?L); *restlessness* and *irritability* (Lebert, 1875 (?L), and Scott, 1944 (?T)); *cerebellar signs* have been noted from time to time and were recorded recently by the Consultant in Tropical Medicine, M.E.F. (1943*b*) (T) quoting a case reported by Major Mann from Cyprus; *encephalitis* is rarely described but was noted by the Consultant in Tropical Medicine, M.E.F. (1942*b*) (?T) in the last war and our *Case 34* appears to be an example of this complication.

McAlpine (1946) (?T) provides a useful brief summary of the neurological findings in this disease in the Middle East during the last war. His 84 collected cases include some of ours. "Notes on Nervous Diseases, etc., M.E.F." (1943) (?T) gives a good description of these complications as they occurred in the same theatre. They are discussed under the headings: (a) *Meningitis*; (b) *Facial palsy*; (c) *Meningo-encephalitis*, acute and chronic; (d) *Other Neurological Complications*—(i) *Cranial nerve palsies*, (ii) *Spinal cord and peripheral nerve lesions*, (iii) *Ocular signs*; (e) *C.S.F. Changes*. The diagnosis and treatment are also discussed.

Ocular Complications

There is a variety of these and they are most commonly found in T-B form. *Papilloedema* occurs usually, but not necessarily with meningitis. In one of our patients (*Case 25*) there was mild unilateral papilloedema although the c.s.f. was completely normal; there was, however, clinical evidence of meningitis. This manifestation is not often recorded. It is mentioned once each by Adler *et al.* (1937) (T) and Coghill *et al.* (1947) (?T) and McAlpine (1946) (?T) states it was found in 11 of his 84 cases. Its occurrence was recorded by the Consultant in Tropical Medicine, M.E.F., in 1942*b*, and 1943*a* (?T), and by Wood and Dixon (1945).

Iridocyclitis is sometimes seen. Elliott (1920) remarks that it has been commonly noticed in the T-B disease. Others who have recorded it have been Adler *et al.* (1937) (T); Consultant in Tropical Medicine, M.E.F. (1943*b*) who quotes 2 cases reported by Lt.-Col. E. Jones from Tunisia, both probably T-B: Hamilton (1943) (?T); Marques (1944) (??T); and Benhamou *et al.* (1946) (?L).

The prognosis of this complication is said to be good by Adler *et al.* (1937) (T) and Hamilton (1943) (?T). In our case of chronic iridocyclitis with little sign of improvement over many years it was the opinion of the ophthalmologist, Dr. J. G. Shelley, that the original cause was not relapsing fever although the latter might have caused an exacerbation of the condition.

Iritis is less rare. Elliott (1920) without reference to type states that it has been "observed with considerable frequency." Drake-Brockman (1914) (?T) reports the condition in 4 cases, Manson and Thornton (1919) (??T) in 3 per cent of 1,500, McCulloch (1925) (?L) in 5 of about 300 cases and Mackie (1927) (??T) found it in 1 case.

Retinitis and choroiditis are rare (Lebert, 1875 (?L)); (Marques, 1944 (??T) and Benhamou *et al.*, 1946 (?L)).

Conjunctivitis is rare but *suffused sclerae* are not uncommon in some series. for example Chung and Chang (1939) (?L) noted it in 47 per cent. of their cases, and it has been recorded by Manson and Thornton (1919) (??T), Sinton (1921) (?L) and Cooper (1942) (?T).

Deterioration of vision was noted as a temporary phenomenon in our *Case 18* who had severe papilloedema. This symptom is recorded once by Adler *et al.* (1937) (T).

Aural Complications

These are unusual. Lebert (1875) (?L) described *tinnitus* as an occasional finding, and Chung and Chang (1939) (?L) record this symptom with *deafness*

in 14 per cent of their cases. Deafness is also mentioned by Manson and Thornton (1919) (??T). These manifestations appear commoner in the L-B form of relapsing fever.

Some Other Features of Relapsing Fever

Allergic reactions at the sites of the bites are recorded by Adler *et al.* (1937) (T) and Cooper (1942) (?T) in some cases.

Sudden Onset.—Most are agreed that this is the usual manner in which both types of relapsing fever start, but some describe premonitory symptoms.

Blood Wassermann Reaction (W.R.).—This has been investigated by a few workers. Manson and Thornton (1919) (??T) found no positive W.R. in a series of cases. Fairley and Sullivan (1919) (??T) noted a few positive reactions among cases of relapsing fever. Roaf (1922) (?L) examined 18 cases of whom 11 gave a positive reaction at some stage of the disease. Pai (1937) (?L) found about half of 13 cases with a positive W.R. No convincing evidence is produced, however, that some of these cases did not have syphilis. Chung (1938) (?L) reported negative W.R.s with positive C.S.F. reactions. However, this author quotes other work with a collaborator in which it was shown that blood W.R.s may be positive in Chinese relapsing fever. Murrell (1939) (T) records a boy of 7 years infected with *Sp. novyi* whose blood gave a positive W.R. Pai (1937) (?L) produces evidence that the blood W.R. is more likely to be positive than the Kahn in relapsing fever. However, Dixon (1943) (T) showed that the latter may be positive in this disease in Cyprus. In all cases the serological reactions are usually positive only in the febrile stages, but this is not invariable. The reactions soon become permanently negative with cure of the disease. This subject is well reviewed by Strong (1945).

Variability of the Symptoms and Signs.—This is a notable feature of relapsing fever, perhaps more especially of the T-B form: (1) in the same case in different paroxysms, particularly remarked on by Adler *et al.* (1937) (T); (2) from case to case in the same series, especially noted by the last author and by Cooper (1942) (?T) and Magee (1942) (?T) and (3) from outbreak to outbreak. This variability is evidently due to the spirochæte affecting different organs predominantly in different cases.

Death.—Mortality varies much in different reported series, from nil up to 50 per cent. or more. It rarely exceeds 10 per cent. in the T-B form and is usually much lower. In the L-B type it is apt to be much higher, although even here it may sometimes be nil. Complications (chiefly respiratory) often account for most of the deaths (Chung and Chang 1939, (?L)). Mortality is influenced in both types by such factors as age, nutritional state and previous health. Nicolle (1932) remarks on the "extreme benignity" of T-B relapsing fever in French N. Africa. No deaths occurred among the 98 military cases of the disease known to have arisen in Cyprus between August, 1941 and April, 1943, and reported by Gambles and Coghill (1948), nor among any of the civilian cases mentioned by the same authors.

Incubation Period.—In most of our cases it was impossible to make even an approximate estimate of the incubation period. In three it was seven days or

less, in two nine or less, and in one each eleven, fourteen or fifteen days or less. In one there was proof that it was ten days. In two other cases not in this series it was less than eleven and fifteen days respectively. In the literature figures for L-B relapsing fever are scanty but do not seem to differ from those for T-B. The average incubation period appears to be about seven to twelve days with extremes of four to sixteen which are seldom exceeded.

Effect of Organic Arsenicals.—This will be discussed in a future publication (Coghill, in preparation).

Numbers of Spirochætes in the Peripheral Blood.—There is little doubt that in most cases of T-B relapsing fever spirochætes are scanty in the peripheral blood at all stages and may be extremely difficult to find. Conversely in the L-B form these organisms are usually very numerous and may be present in enormous numbers. It is possible that the numbers of circulating spirochætes bear some relation to the kind and degree of manifestations in both forms of the disease. Spirochætes may sometimes be found in the blood during afebrile periods, probably a commoner finding in the L-B form. Robinson (1942) (?L) recorded this phenomenon in 38 per cent. of cases. Cooper (1942) (?T), however, also noted it in 35 per cent. In the present cases it was often difficult to find spirochætes in blood films taken during the febrile stage and they were always in relatively small or scanty numbers.

Period in Hospital, etc.—The “Period of incapacity” is a not altogether satisfactory term which represents in this case either the period the patient was in hospital and convalescent depot, or the duration of his disease. After treatment there was sometimes long periods between relapses. During such asymptomatic periods patients may have been back at their units and able to work; these periods are included in the figures given under “incapacity.” 11 were “incapacitated” between thirteen and thirty days, 5 between thirty-one and fifty, 4 between fifty-one and sixty, 3 between sixty-one and seventy, 4 between seventy-one and eighty, 3 between eighty-one and ninety, 1 between ninety-one and one hundred, 1 between 101 and 110, 2 between 111 and 120 and one for 131 days. 15 (not quite half the cases) were therefore “incapacitated” for over sixty days (two months). Other writers record similar prolonged periods of “incapacity” which are usually longer in the T-B form. Cooper (1942) (?T) records such periods up to twenty-six weeks, and the patients reported by Sautet (1941) (T) were ill for five months. Although in T-B relapsing fever numbers are often small in relation to the total population at risk, this aspect is of some importance from the military point of view and stresses the need for improved treatment.

Complicating Diseases

Five cases of malaria (all Indian) among a series such as this would appear to be rather excessive. Others have suggested that there may be a relation between the two diseases, and that relapsing fever interferes in some way with the body's premunity mechanisms, so favouring a relapse of the malaria in a patient who is chronically infected as are many Indian other ranks. There is little evidence to agree with the suggestion of Hamilton (1943) (?T) that malaria exerts any beneficial effect on relapsing fever, as it does on a tertiary stage of syphilis (G.P.I.).

CONCLUSIONS

The main difficulties in the clinical diagnosis of the relapsing fevers are:

- (1) The symptomatology in any given case in the first attack may not be unlike that of other quite different conditions.
- (2) There may be very few symptoms and signs in many cases.
- (3) There are, perhaps not unnaturally, considerable similarities between the two forms of the disease.
- (4) There is a lack of clinical uniformity.

Examination of a blood film is undoubtedly the best method for arriving at an early non-specific diagnosis of relapsing fever. The further clinical differentiation of relapsing fever into its two types presents greater difficulties. Those who have seen both at different times, such as Boyd (1919), Calwell (1920), Mackenzie (1920) and Woodcock (1920) remark on the clinical differences of the two conditions. Cunningham (1925) states: "There is no doubt that two definite clinical varieties of the disease exist, the louse-borne and the tick-borne."

Nicolle (1932) makes an attempt at differentiation on clinical and other grounds. Rogers and Megaw (1944) also make an effort in this direction, but it is doubtful if some of the special features they attribute to L-B relapsing fever are in fact so specific to this form. They mention heart changes. These have been reported in accounts of cases of both kinds but evidence adduced that the heart is actually affected is nearly always scanty and unconvincing.

As a result of the present analysis of the literature it may be said that the following manifestations are much more common in T-B than L-B relapsing fever: Two or more relapses (untreated): spirochætes scanty in the peripheral blood; relatively short paroxysms of not more than five to seven days; prolonged irregular fever; vomiting chiefly with meningitis only; lethargy and weakness; giddiness (probably not true vertigo); loss of weight; debility; neurological complications of all kinds of which the commonest are lymphocytic meningitis and cranial nerve palsies; ocular complications, chiefly papilloedema (mostly with meningitis) and iridocyclitis; allergic reactions at the sites of tick bites; poor therapeutic effect of organic arsenicals; illness relatively less severe; mortality usually very low (10 per cent or much less).

The following manifestations *may* be commoner in T-B than L-B relapsing fever: Variability of the symptoms and signs in the same case from paroxysm to paroxysm, and from case to case; mild anæmia; monocytosis; herpes simplex; iritis.

The following are much more common in L-B than T-B relapsing fever: Less than two relapses, often none; spirochætes numerous in the peripheral blood; relatively long paroxysms, maybe up to ten days; vomiting at any stage; hæmorrhagic manifestations of all kinds; diarrhœa; jaundice, especially if severe; very fair therapeutic effect of organic arsenicals; illness relatively more severe; mortality often high (up to 50 per cent, sometimes higher).

The following *may* be commoner in L-B than T-B relapsing fever: Constipation; thirst; leucocytosis; hepatic tenderness and enlargement; aural complications, chiefly tinnitus and deafness.

These lists cannot, for the most part, be said to indicate striking differences

between the two forms of the disease. Some of the points are of feeble diagnostic value either because they are rare in any relapsing fever or common in other diseases. However the differences noted, such as they are, can be considered worth drawing attention to as a preliminary attempt to define the two conditions clinically and may perhaps stimulate further observation. It is interesting to speculate, for example, if there is any real basis for describing all relapsing fevers (L-B or T-B) in terms of the geographical location of the disease. What is particularly needed is careful differentiation of the spirochæte (T-B or L-B) in all types of clinical case and in different localities.

SUMMARY

(1) Representative histories are given from among 35 collected military cases infected in Cyprus. Various clinical aspects are commented upon and examples of "atypical" cases are reported.

(2) The symptoms and signs found in this series of cases are summarized.

(3) In Cyprus the chief complications were neurological and appeared in 21 per cent of cases. The present series included 3 cases of meningitis, 2 of facial palsy, 1 of encephalitis and 4 of papillœdema.

(4) In nearly half the patients the disease lasted over two months.

(5) From an analysis of the manifestations in the present series and those recorded in the literature an attempt is made to differentiate tick-borne from louse-borne relapsing fever on clinical grounds. Lists of symptoms and signs are compiled which, from reports, seem commoner in one or other condition. Only partial success is achieved in this attempted differentiation. One of the greatest difficulties is the lack of evidence in most publications as to the vector. This point is stressed and a plea made that in future more attention be paid to this point so that clinical differentiation may be facilitated.

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DISORDERS OF MICTURITION IN POLIOMYELITIS

Some Observations on Pathology and Treatment

BY

D. S. SHORT, M.D., M.R.C.P.

Most textbooks give the impression that the bladder is seldom paralysed in poliomyelitis (Strumpell, 1931; Osler's Medicine, 1944; Brain, 1947). In the case of children this is probably so, but such an event is by no means rare in adults.

There are references to the occurrence of urinary symptoms in the earliest epidemics reported in American literature. Caverly (Infantile Paralysis in Vermont, 1924) mentioned them in connexion with three of the epidemics in Vermont. In 1894, there were 110 paralytic cases of which ten had retention of urine and two incontinence. In 1910, there were 69 cases of which 17 had retention, 4 incontinence and one frequency. In the small outbreak of the following year, 13 of the 27 paralytic cases had urinary symptoms. In 1913, a case was also reported in France (Schreiber and d'Allaines).

Bugbee (1925) claimed to be the first to report paralysis of the bladder as an initial manifestation of poliomyelitis. Eight years later, Toomey (1933) published details of 60 cases with urinary symptoms out of a total of 386 cases seen over a period of ten years, and noted that in 42 such symptoms preceded the onset of somatic paralysis.

The largest series of cases with bladder involvement seen in one epidemic was reported by Wright (1936), though his handling of the figures makes it impossible to tell the exact incidence. In the Los Angeles epidemic of 1934, 1,792 cases of poliomyelitis were diagnosed and he selected 420 for analysis "chosen at random, except that half were under 15 and half over 15 . . . Of the 210 under 15, 20 per cent had disturbed urinary functions during the acute stage, varying from slowness in starting to void to complete retention. In the younger children palliative measures were nearly always sufficient to relieve the symptoms, but in the older children the complaints were both more frequent and more difficult to relieve . . . Of the 210 adults, 65 per cent had disturbed urinary function." Apart from the high incidence of urinary symptoms, the other feature of note in this epidemic was the frequency of peripheral neuritis.

Poliomyelitis became a cause of considerable concern to the Army Command in India during the 1939-45 war. Although the actual number of cases was small, the high mortality made it the leading cause of death in many parts of the country. In Bombay, where the author spent the greater part of his service overseas between 1944 and 1947, poliomyelitis was responsible for

more than twice as many deaths as any other disease and actually accounted for almost half the deaths of officers during this period.

The clinical picture was very varied. The ordinary spinal type was that most commonly seen, though it tended to be particularly severe, with extensive paralysis and a high incidence of urinary symptoms. The ascending form was also frequently observed and accounted for most of the fatalities (*see* Table I).

TABLE I. TYPE OF CASE

(Deolali, 1946, and Bangalore, 1946, are included for comparison)

	<i>Non- paralytic</i>	<i>Spinal</i>	<i>Ascending</i>	<i>Bulbar</i>	<i>Ence- phalitic</i>	<i>Total</i>	<i>Deaths</i>
Bombay, 1944 ..	—	3	6	—	1	10	7
Bombay, 1945 ..	1	8	1	—	—	10	1
Bombay, 1946 ..	—	10	6	2	—	18	7
Deolali, 1946 ..	—	3	3	—	—	6	3
Bangalore, 1946 ..	13	6	1	1	1	22	2

The author saw some 45 adult cases of acute poliomyelitis in India and Burma. This communication is based on 26 of these which were under his observation for a sufficient length of time for careful study to be undertaken. In 22, the disease was contracted in Bombay: 20 were patients in the British Military Hospital, and the other two were seen on board ship between Bombay and Aden. Of the rest, 3 were patients in the British Military Hospital, Deolali and one in the Combined Military Hospital, Bangalore. All these cases were British servicemen, aged between 20 and 30, who had previously been quite fit.

Autopsies were performed on most of the fatal cases, but investigation was limited by the limited local facilities for histology and virus study. The characteristic naked-eye appearance consisted of meningeal hyperæmia and congestion of the spinal cord with occasional points of petechial bleeding.

Urinary Symptoms.—Of the 26 cases, 20 had symptoms of disturbed bladder function and, in 12, urinary symptoms preceded or appeared simultaneously with the onset of somatic paralysis. Seventeen cases had retention of urine lasting twenty-four hours or more and the other 3 complained of difficulty in emptying the bladder. In one patient, frequency of micturition and dysuria preceded retention. The bladder was palpable in 16 cases and 15 required catheterization.

Loss of bladder function was generally short-lived and normal micturition returned (provided the illness was not fatal) in from one to four days. Only one case failed to recover in this period. As there was still no sign of returning function after three weeks, the surgical specialist advised supra-public cystostomy and the bladder was still paralysed two months later when he was evacuated to the United Kingdom.

In 3 cases with retention of urine the effect of a subcutaneous injection of carbachol 0.25 mg. was tried. In Case K—a mild case with paresis of the abdomen and bilateral involvement of the hip girdle—there was an immediate response, one and a half pints of urine being voided. The bladder subse-

quently refilled, however, and a second injection had no effect. Normal function returned after thirty-six hours. Case O was also mild, with paresis affecting the abdomen, the left upper limb and the right iliopsoas. There was a good response to the injection and the patient passed urine normally thenceforward. The third case, P, was a severe one with involvement of both upper limbs, abdomen and chest, who was being given atropin 0.6 mg. four-hourly to keep the respiratory tract dry. Carbachol failed, probably on account of the antagonistic action of the atropin.

Other Clinical Features.—The clinical features of these cases have been reported in detail elsewhere (Short, 1948) so a brief summary only will be given here. The distribution of the paralysis in the individual cases is shown in Table II and the spinal segmental distribution in fig. 1. Two points call for

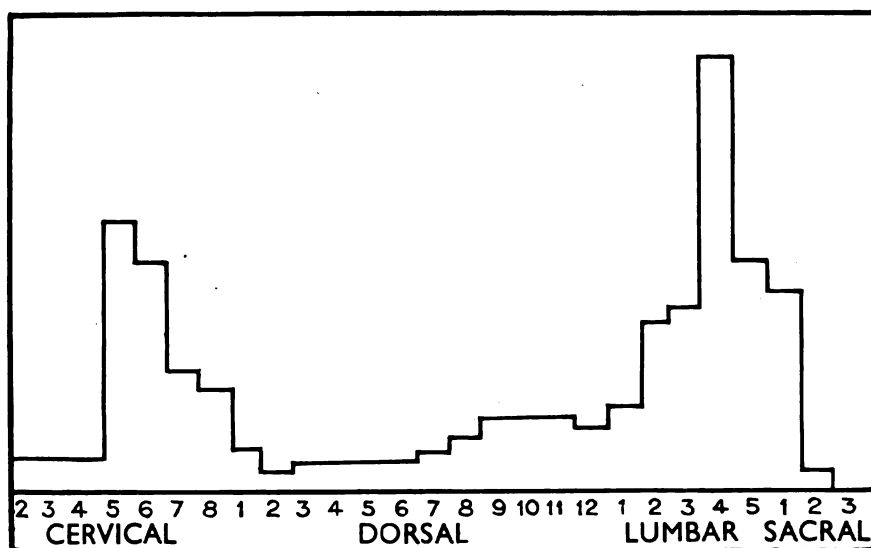


FIG. 1.—Spinal segmental distribution of paralysis in 26 Bombay Service cases, showing two peaks, one in the cervical and the other in the lumbar region. Greatest incidence on the fourth lumbar segment.

special notice. The first is the frequent involvement of the upper limb which was paralysed, either alone or in combination with a lower limb, in 15 of the cases. The second concerns the peculiar distribution of the paralysis in the lower limb, where the fourth lumbar segment was more severely affected than the fifth lumbar and first sacral segments. The muscles most commonly and severely paralysed were the iliopsoas, the abductors and adductors of the thigh and the quadriceps femoris. The glutei were affected less than half as often as the iliopsoas, while the tibialis anterior and the peronei, usually regarded as the most vulnerable of the lower limb muscles in poliomyelitis, were rarely paralysed unless (or until) the lower limb was extensively involved. Eleven cases had a paralysis limited to the hip girdle whereas only two developed foot-drop without any paralysis above the knee. In a large proportion of the cases

TABLE II. DISTRIBUTION OF PARALYSIS IN 26 CASES

Muscle Group	Case	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	Total
		RL	RL	RL	RL	RL	RL	RL	RL	RL	RL	RL	RL	RL	RL	RL	RL	RL	RL	RL	RL	RL	RL	RL	RL	RL	RL	RL
Cranial	...	++																										2
Trebezius	...																											8
Deltoid	...	0																										15
Spinati	...	0																										12
Pectorales	...																											11
Biceps	...																											18
Triceps	...	00																										19
Forearm	...																											12
and hand	...																											
Intercostals	...	00																										10
Erector Spinae	...	++																										11
Abdominals	...	00																										16
Bladder	...	00																										20
Iliopsoas	...	++																										29
Glutei	...	++																										14
Abductors	...	++																										20
Adductors	...	++																										22
Quadriceps	...	++																										21
Hamstrings	...	++																										15
Gastrocnemius	...	++																										18
Tibialis ant.	...	++																										14
Peronei	...	++																										11
Foot	...	++																										6

Dec., 1945—June, 1947
June, 1947
June, 1946—April, 1947
March, 1947

B.M.H., Bombay,
Atsea,
B.M.H., Deolali,
C.M.H., Bangalore,

Note 1—Cases A—T
U, V, X, Y, Z

Note 2—+ = paresis
0 = paralysis

inability to lift one lower limb off the bed was the first sign of somatic paralysis. At this stage paresis could usually also be demonstrated in one or more of the following groups: the adductors of the thigh, the abductors, or the muscles of the abdominal wall. Two severe and rapidly fatal cases developed a quadriplegia; in these the proximal and distal muscles were involved equally.

The abdominal muscles were paralysed in 16 cases, the erector spinæ in 11 and the intercostals in 10. A triad frequently observed was paralysis of the abdominal wall and the iliopsoas (on one or both sides) together with retention of urine.

Three severe non-fatal cases were seen in which retention of urine was associated with an extensor plantar response. (In view of the frequency with which the abdominal muscles were paralysed in this series, absence of the abdominal reflexes was without value as an indication of a pyramidal lesion.)

Case E, an officer, aged 21, was admitted to the C.M.H., Kalyan (in April) with two days history of severe girdle pains around the lower part of the chest and slight difficulty in starting micturition. Apart from a band of hyperæsthesia across the epigastrium, there were no abnormal physical signs at this stage. On the day following admission, the patient complained of backache, and definite neck rigidity was present. All the deep reflexes were exaggerated but both plantar reflexes were still flexor. Next day he developed paresis of both legs with retention of urine. During the succeeding days the paralysis extended until both lower limbs, the abdominal wall and the left arms were paralysed. The left plantar reflex was now extensor. Suprapubic cystostomy was performed twenty-four days after admission. Two months later, on evacuation to the United Kingdom, the bladder was still paralysed and the left Babinski reflex positive.

Case K, an officer, aged 22, was admitted to the B.M.H., Bombay with a history of two days headache. Frequency of micturition and dysuria had been noted on the morning of admission, and when the patient tried to stand he found his legs were weak. Retention of urine developed and was at first relieved by carbachol, 0.25 mg., though subsequently catheterization became necessary for forty-eight hours. There was marked paresis of the abdomen and hip girdles and both plantar reflexes were extensor. After forty-eight hours the left plantar reflex returned to normal but the right was still extensor fifteen days after when the patient was last examined prior to his transfer to an orthopædic centre.

Case T, was admitted to the B.M.H., Bombay, with paralysis of the abdomen, erector spinæ and the left lower limb, paresis of the right lower limb and retention of urine. An extensor plantar response was obtained on the left side. The author did not have an opportunity of following this case further so the duration of pyramidal involvement is unknown.

DISCUSSION

That the symptoms of poliomyelitis are more severe in adults, the paralysis more extensive and the mortality higher has frequently been observed (Limper *et al.*, 1931; Nissen, 1947; Short, 1948). Parallel with this greater severity goes a higher incidence of urinary symptoms. Wright's observation (1936) that paralysis of the bladder was more frequent in the higher age groups has repeatedly been confirmed in subsequent epidemics involving the adult population. Urinary symptoms have figured prominently in the reports on outbreaks of poliomyelitis among service personnel during the 1939-45 war. In the 1942-3 Malta epidemic, bladder involvement was observed in over 20 per cent of the Service cases (Bernstein *et al.*, 1945); whereas of the 426 civilian cases,

98.5 per cent of whom were under 10 years of age, only one required catheterization (Agius *et al.*, 1945). Van Rooyen and Morgan (1943) mentioned retention in two and incontinence in one of their seven brief case-histories of soldiers who died of poliomyelitis in Egypt.

Poliomyelitis is by no means rare among the native population of India though, owing to the absence of large epidemics, it has as yet received little attention. The disease is virtually confined to infants and young children. In Bombay, urinary symptoms are said to be uncommon though, interestingly enough, the only adult Indian known to have contracted the infection in the past ten years suffered from retention of urine.

Pathogenesis of Urinary Symptoms.—The site of the lesion responsible for urinary symptoms in poliomyelitis has hitherto received little attention, probably on account of the belief that such symptoms are uncommon. Hence it has been assumed either that the vesical centre in the spinal cord is affected or that there is some damage to the nerves supplying the bladder.

The physiology of micturition is complex. At least six reflexes have been described and four centres have been postulated. The primary reflex is a contraction of the detrusor evoked by distension of the bladder. The pelvic nerves form both the afferent and efferent limbs of this reflex arc which has its centre in the hind-brain. Some of the subsidiary reflexes have their centre in the sacral cord, probably in the second, third and fourth sacral segments. There is believed to be a third centre in the mid-brain, and the presence of voluntary control presupposes the existence of a fourth centre at the cortical level. The connexions between these four centres are as yet imperfectly understood. Reflex contraction of the detrusor is reinforced by voluntary contraction of the abdominal wall, diaphragm and muscles of the pelvic floor.

With such an intricate system of nervous control, micturition may be upset by lesions at many different levels. Thus paralysis of the bladder may result from such varied causes as injury to the cauda equina or sacral cord, transverse myelitis of the lumbar or dorsal segments and cerebral thrombosis.

In view of the known affinity of the virus of poliomyelitis for the motor horn cells, it is reasonable to consider first the possibility of a lesion of the sacral centre. There are two strong arguments against this conception of the pathology in the cases seen in Bombay. In the first place, if the lateral grey columns were damaged it would be reasonable to expect that the anterior grey columns of the same segments would also be damaged. No such association was in fact observed; voluntary muscles innervated by the second sacral segment being rarely involved and those innervated by the third segment never. On the other hand, 7 cases were observed (Cases B, G, J, N, O, V, Z) with retention of urine in which there was no evidence of cord involvement below the fourth lumbar segment. It is hard to believe that in these cases the lateral columns of the sacral cord were picked out and the anterior columns spared. The muscles most frequently paralysed in patients with retention of urine were the abdominals and the hip flexors—muscles deriving their nerve supply from the lumbar and lower dorsal segments. The other argument against the theory of damage to the sacral centre is the fact that bladder symptoms were

almost invariably transient. In only one case (Case E) did retention of urine persist beyond four days. In all the other patients, normal micturition was established long before any return of power could be detected in the voluntary muscles affected. In Case E, paralysis was still complete after two months and in this single instance damage to the neurones in the sacral cord may reasonably be assumed. It is noteworthy that this patient also had paralysis of voluntary muscles innervated by the sacral cord.

Toomey (1933), impressed by the observation that paralysis of the detrusor was rarely accompanied by paralysis of somatic muscles supplied by the same spinal segment, postulated a peripheral lesion. In the following year there occurred the Los Angeles epidemic with the highest incidence of urinary symptoms yet recorded. This epidemic was peculiar, however, in that frequency of micturition and attacks of acute vesical distress were common and kept recurring over a period of eighteen months. Many of the cases also had signs of peripheral neuritis. Wright (1936) concluded that the bladder symptoms were due to a peripheral neuritis. This was manifestly an unusual epidemic and it would be unwise to generalize from these conclusions.

Neither of the above theories offers a satisfactory explanation of the transitory retention of urine which was observed in so many of the Bombay cases. The possibility of a lesion interrupting the pathway between the centre in the sacral cord and that in the hind-brain must therefore be considered. Retention of urine is a characteristic symptom of a transverse myelitis involving the lumbar or dorsal cord, and this may result from a great variety of pathological processes including infections, toxicoses and toxi-degenerations. Among the infective agents, the virus of poliomyelitis is a rare cause (Wilson, 1940)—the inflammatory reaction in the anterior grey columns being so intense that it overflows into the white matter. Less rarely, poliomyelitis gives rise to a minor degree of the condition with evidence that one or more of the long tracts is involved—particularly the pyramidal and spino-thalamics. There were three cases with extensor plantar responses in the present series all of whom suffered from retention of urine. It is suggested that in these three cases the urinary symptoms had the same pathological basis as the pyramidal lesion. If this is so, is it not conceivable that in other cases the tracts subserving bladder control might be compressed and interrupted without the œdema being extensive enough to interrupt the pyramidal tracts sufficiently to give rise to an extensor plantar response? Such an explanation appears to fit the facts better than any other. It has its basis in established pathology, for œdema and swelling of the cord in those segments where there is extensive damage to the anterior grey columns has frequently been observed. Since the site of the disturbance may be at any level above the sacral cord, it accounts for the association of urinary symptoms with somatic paralysis of a lumbar and lower dorsal distribution. Furthermore, the brief duration of the bladder paralysis is readily understood if the œdema of the cord is regarded as a short-lived accompaniment of the phase of neuronal destruction.

There may be some cases in which retention of urine is due simply to paralysis of the abdominal muscles without any defect in the reflex mechanism

controlling micturition. The detrusor is used to relying in some measure upon a voluntary raising of the intra-abdominal pressure. If this support is withdrawn and particularly if, in addition, micturition has to be attempted in an unaccustomed position—in bed, for instance—retention may result. After a few days the detrusor readjusts itself; sometimes also the patient finds a particular position in which the act can be performed. This explanation cannot be held to account for more than a small proportion of the 20 cases with urinary symptoms described in this paper for almost half of them developed retention of urine before paresis of the abdomen, 3 cases showed no abdominal weakness at any time, and in one frequency and dysuria preceded retention.

The Use of Carbachol.—It seems so obvious to attempt to relieve retention of urine in poliomyelitis by the administration of carbachol that it is remarkable that none of the neurological textbooks mention the drug. Indeed, the author has been unable to trace any mention of its use in the literature, though this is so voluminous that some reference may well have escaped his notice. The omission is the more remarkable in view of the fact that its close cousin, prostigmine, is undergoing extensive trial in the U.S.A. as a stimulant of paralysed muscles in the early convalescent stage (Kabat and Knapp, 1943; Boines, 1944; Eveleth and Ryan, 1944). Moreover, carbachol is of proved value in the neurogenic retention of urine occurring in the course of tabes dorsalis (Langworthy, 1936).

In the three cases in this series in which it was tried, there was one complete and one partial success. It is not clear why in the latter there was no response to a second injection. The failure to obtain a response in Case P may well have been due to the fact that he was receiving atropin 0.6 mg. four-hourly in an attempt to keep the respiratory tract dry. It has been shown that such a dose of atropin completely blocks the normal effects of carbachol 0.3 mg. 20 minutes later (Goodman and Gilman, 1941).

Besides the two cases noted above, the author is able to report two other successes. An adult male civilian in Bombay developed poliomyelitis with extensive paralysis below the waist and retention of urine. By the use of "Moryl" an evacuation of the bladder was obtained twice daily for four days at the end of which period normal function returned. The other case was a man aged 49 with severe paralysis of both legs and the abdomen. When first seen, he had already been catheterized. Twelve hours later, when the bladder was again distended he was given carbachol 0.25 mg., and as there was no response a second injection of 0.5 mg. was given. There was still no response so twelve-hourly catheterization was instituted. After three weeks, by which time the question of cystostomy was being seriously considered, an injection of carbachol 0.25 mg. was tried again. This time it was successful and the patient was able to pass urine normally thenceforward.

SUMMARY

Urinary symptoms, though infrequent in infants and young children are not uncommonly seen in adult cases of poliomyelitis.

Of 26 cases of poliomyelitis in Service personnel in India, 20 had urinary symptoms and 15 required catheterization.

Paralysis of the bladder was generally transitory and in all but one case normal function had returned by the end of the fourth day.

The site of the lesion responsible for the urinary symptoms is discussed. The view is advanced that in the majority of these cases the essential pathology was an inflammatory œdema around the damaged anterior grey columns of the lumbar or dorsal cord interrupting the tracts linking the bladder centre in the sacral cord with that in the hind-brain.

Carbachol is sometimes successful in producing an evacuation of the bladder and should always be tried before resorting to catheterization.

My thanks to Col. F. M. Lipscomb for much helpful criticism.

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ORAL MANIFESTATIONS OF AGRANULOCYTOSIS

BY

Major E. D. STANHOPE, M.B.E., H.D.D.Edin.

Royal Army Dental Corps. Specialist Dental Officer.

AGRANULOCYTOSIS is fortunately a rare condition but, nevertheless, the following three cases, all of which were seen within a period of fifteen months, illustrate the necessity of keeping it in mind when endeavouring to arrive at a diagnosis. The importance of the oral manifestations of this symptom-complex were emphasized by Mark (1934) who stated: "The frequency of the mouth lesions as the first clinical phenomenon and the rapidly fatal progress of the disease make it imperative for the dentist to be wary of treating ulcerative, non-specific lesions of the oral cavity locally, and to co-operate with the physician in ruling out the possibility of a blood dyscrasia."

CASE REPORTS

In this series all three cases were males, the first two being seen at 94th (Hamburg) British Military Hospital, and the last at the Military Hospital, York.

Case 1.—The patient, aged 20, gave a history of attending the Venereology Department where he was undergoing anti-syphilitic treatment. He was referred to the Dental Centre complaining of severe pain in his mouth. When he was examined on December 3, 1947, a large circumscribed ulcer over an inch in diameter was found on the buccal mucosa situated about the middle of the inside of the left cheek. This was surrounded by a well-defined area of petechiæ, but there was no tendency towards spontaneous hæmorrhage either from the ulcer or anywhere else in the mouth. The ulcer was covered by a greyish slough and there appeared to be some induration of the skin on the outside of the cheek corresponding to the situation of the ulcer. The patient also complained of a general feeling of malaise. A request was made to the Pathology Laboratory for a blood count. This revealed W.B.C. 4,400 of which only 3 per cent were neutrophils. The patient was immediately placed under the care of the medical specialist and a diagnosis of agranulocytosis was made. Constant and careful treatment of the local lesion was considered imperative as it was already serious and if allowed to spread uncontrolled it was thought it might well proceed to a noma. Again it was obviously desirable that no further drain should be put on the already grossly depleted stock of neutrophils available to combat this infection. Local applications of penicillin coupled with frequent hot saline mouthwashes were considered to be the best therapeutic agents for this means. The patient was given penicillin lozenges throughout the day while the medical specialist had already prescribed intramuscular penicillin. Subsequent blood counts were as follows:—

December 4 :	W.B.C. 4,300, neutrophils 2 per cent
December 6 :	W.B.C. 4,300, neutrophils 6 per cent
December 8 :	W.B.C. 5,500, neutrophils 15 per cent
December 13 :	W.B.C. 7,100, neutrophils 35 per cent
December 21 :	W.B.C. 8,000, neutrophils 57 per cent

The improvement in the blood count was accompanied by resolution of the mouth lesion. A crust formed over the ulcer which rapidly decreased in size, the petechiæ disappeared and the induration of the cheek subsided. By December 21 the ulcer had healed completely.

Case 2.—This case was somewhat unusual in that the agranulocytosis occurred as a complication while the patient was undergoing treatment for a fracture of the mandible.

On July 30, 1948, the patient, aged 45, fell downstairs and sustained a bilateral fracture of the mandible. On August 4, he was operated on under endotracheal anaesthesia. As he was edentulous and the fragments of the mandible were displaced, Gunning splints were fitted to the maxillary and mandibular alveolar processes and were held there in position by circumferential and alveolar wiring. Black gutta-percha was not available for lining these splints, so tulle gras was used as a substitute. On August 21 the patient complained of malaise and had moderate pyrexia. There was also considerable pain in his mouth and throat, and extensive ulceration could be seen on the buccal mucosa. Cervical lymphadenitis was present to a marked degree. At the time it was thought that the ulceration may have been traumatic in part, due to the inefficient lining of the splints with tulle grass. In view of the malaise and pyrexia the Medical Specialist was requested to see him, and he in turn requested a blood count. This revealed W.B.C. 3,200, neutrophils 2 per cent, and a diagnosis of agranulocytosis was established. In addition to the intramuscular penicillin and pentnucleotide which the medical specialist prescribed, treatment of the mouth lesions was instituted on the lines described in *Case 1*. An added potential complication in this case was the risk of an osteomyelitis if the infection should spread uncontrolled along the sites of the deeply placed circumferential and alveolar wires. Fortunately, however, this did not occur. Subsequent blood counts showed a gradual improvement until on August 27 the count was W.B.C. 14,250, neutrophils 44 per cent. Again the mouth lesions had improved with the general condition. The pain had subsided, and the ulcers were almost healed. The remainder of the treatment for the fracture of the mandible was quite uneventful and, on September 14, when the Gunning splints were removed, bony union between the mandibular fragments had taken place.

Case 3.—The patient, aged 29, was referred from a nearby R.A.F. Dental Centre where he had been under treatment for gingivitis for about two weeks. An attempt had been made to extract the upper left second premolar but the tooth had fractured during the process. He was also suffering from severe conjunctivitis. When he was examined on February 8, 1949, he was pale and said he felt ill. Intra-orally there was moderate ulceration of the gingivæ and he complained of pain where the tooth had been broken. Owing to this ulceration it was thought wise to defer the extraction of the premolar root for the time being, and so its surface was cauterized with phenol to attempt to alleviate the pain and local treatment for the gingivitis was commenced with penicillin lozenges. He was referred to the Eye Specialist for treatment of the conjunctivitis. By February 11, the eye condition had subsided but he now complained of severe pain from the broken tooth. As the ulceration of the gingivæ had improved considerably it was thought safe to proceed with the extraction of the premolar root, and this was done under nitrous oxide anaesthesia without difficulty.

On February 15 there was a small, shallow, irregular shaped ulcer on the hard palate around which there was no evidence of inflammatory reaction. The patient also stated he had a slight spontaneous hæmorrhage from his gums during the night. A request was made to the Pathology Laboratory for a blood count. This revealed W.B.C. 3,000, neutrophils 30 per cent. He was referred without delay to the medical specialist, who obtained a further history that up to two weeks previously the patient had been receiving anti-syphilitic treatment. A diagnosis of agranulocytosis was made and he was placed on intramuscular penicillin and pentnucleotide. Local treatment for the mouth was prescribed as for the previous cases. On February 17 the blood count was as follows: Hæmoglobin 77 per cent, W.B.C. 1,050, neutrophils 12 per cent. Three days later the hæmoglobin had dropped to 66 per cent, W.B.C. to 1,000, only 2 per cent of which were neutrophils. Also the platelet count was only 30,000. The pathologist carried out a

sternal puncture and found severe aplasia of further elements of the hæmopoietic tissue. He considered the diagnosis appeared to be that of aplastic anæmia. Intra-orally the ulceration of the hard palate was static but there had been further spontaneous hæmorrhages from the gingivæ, and the blood clot in the recently extracted premolar socket showed no signs of organizing. The patient also complained of dysphagia and pain in the throat. Further blood counts were as follows:

February 24: Hæmoglobin 56 per cent, W.B.C. 800, neutrophils 4 per cent.

February 26: Hæmoglobin 53 per cent, W.B.C. 500, no neutrophils could be seen.

February 28: Hæmoglobin 49 per cent, W.B.C. 300, no neutrophils. Platelets were less than 20,000.

The colour index had remained at unity in the above counts so the decrease in R.B.C. was proportionate to that of the hæmoglobin.

Despite all efforts by the Medical Specialist such as transfusion and treatment with B.A.L., his general condition had gradually deteriorated and on March 1 he died. At the time of death his mouth condition was no worse than it had been a week previously.

DISCUSSION

The foregoing cases serve to show the great variation in form, severity and site of the oral manifestations which may be expected in agranulocytosis. There is nothing characteristic about these lesions except perhaps a complete lack of reaction of the surrounding tissues to infection and an absence of any local cause for the lesion. The spontaneous hæmorrhages in *Case 3* were merely a manifestation of the greatly decreased number of platelets and would not, of course, occur in cases of true agranulocytosis where the involvement only concerns the granulocytes. Again, the patient may be ambulatory and arrive at a Dental Centre giving little hint as to the serious underlying general condition. It is apparent that the Dental Officer is in no position to make a diagnosis from the clinical aspect of agranulocytosis as it concerns him, but his suspicions may be aroused by the presence of a non-specific ulceration in the mouth coupled with a history of recent treatment by a drug which may depress the hæmopoietic function of the bone-marrow, and to which the patient may exhibit an allergy. These suspicions should be confirmed or discounted immediately by hæmatological examination, and if the count is abnormal steps should be taken to place the patient under the care of the Medical Specialist with the least possible delay. From current literature, examples can be provided to show that dental extractions appear to precipitate the condition and so all but the most urgent surgical intervention should be postponed.

For treatment of the general condition, penicillin therapy seems to have decreased considerably the number of cases of agranulocytosis terminating fatally. Leitner (1949) goes so far as to state "Almost all cases of acute agranulocytosis can be saved especially when treated early enough by the use of penicillin." This makes the establishment of an early diagnosis even more important than ever and, as has been shown, the dental officer is often in a position to render valuable help in this direction. Once a diagnosis has been made it is essential that, if a mouth lesion is present, however small it may be, it should be treated with the most constant and careful attention to keep it under control and to conserve the precious granulocytes. In these case reports, an attempt has been made to describe some of the varying mouth lesions of agranulocytosis and to suggest a line of local treatment for them, but

obviously they cannot be considered as an isolated syndrome. As Appleton (1932) expresses it in a comprehensive article on agranulocytosis "The condition or conditions indicated by this term well illustrate the essential unity of Medicine."

SUMMARY

- (1) Two cases of agranulocytosis and one of the allied condition, aplastic anæmia, are reported.
- (2) The varying mouth lesions of these cases are described.
- (3) The importance of an early diagnosis and the possibility of the oral manifestations appearing as the first clinical sign are stressed.
- (4) Prompt hæmatological examination and reference to a medical specialist are emphasized.
- (5) The necessity of careful treatment of the mouth lesions is stated.

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Obituary

Colonel STEVENSON LYLE CUMMINS, *C.B.*, *C.M.G.*

It is with great regret that we record the death of Colonel S. Lyle Cummins, a former Editor of the *JOURNAL OF THE ROYAL ARMY MEDICAL CORPS*, which took place at Oxford on May 26, 1949.

He was born in Cork on June 18, 1873, the son of the late W. J. Cummins, M.B. He qualified M.B., B.Ch., B.A.O., R.U.I. in 1896. He took the D.T.M.&H. (Cambridge) in 1907 and proceeded M.D. in 1913.

He was given an Honorary LL.D. by the N.U.I. in November 1919.

He entered the Army as a Surgeon-Lieutenant on July 28, 1897, which date was his seniority as a Lieutenant in the Royal Army Medical Corps. He was promoted in due course, reaching the rank of Colonel in 1918. From January 17, 1899, to January 6, 1909, he served with the Egyptian Army, having taken part in the Nile Expedition of 1898. He was in the Sudan from 1900 to 1902 and again in 1904. He was awarded the Order of Osmanieh, 4th Class, in 1907.

In the European War—1914–1918—he served in France and Flanders. He was awarded the *C.B.* and the *C.M.G.* as well as a Brevet Colonelcy. He further gained a Legion of Honour (officier) and the Couronne de Belgique (officier).

His professional career was outstanding and his choice of Pathology as a subject was largely due to the influence of Almroth Wright of whose class he was a member at Netley. Readers may recall the spirited pen and ink sketch of Almroth Wright which, drawn by Lyle Cummins while a student, appeared in the *Journal* of June 1947. In 1913 Lyle Cummins won the Parkes Memorial Prize and medal for a paper on "The Causation and Prevention of Enteric Fever on Military Service."

He was assistant Professor of Pathology at the Royal Army Medical College from August 22, 1913, to February 1, 1914, when he became Professor, holding this appointment to August 4, 1914. He later was Adviser in Pathology to the British Armies in France and Flanders.

The war ended, he returned to the R.A.M. College to be Professor of Pathology from July 1, 1919, to January 31, 1921.

He retired on February 1, 1921.

It says much for the professional reputation that he had built up in the Army that shortly after his retirement in 1921 he became Professor of Tuberculosis at the Welsh National School of Medicine where he remained until 1938. He was also Director of Research to the King Edward VII Welsh National Memorial Association.

From December 1940 he assisted in collecting material for the compilation of the *Medical History of the War*.

He was the author of the article on Influenza in the *Encyclopædia*

Britannica and of that on Kala Azar and allied Leishmania diseases in Oxford Medicine, Vol. V.

He wrote on "Tuberculosis in Primitive Tribes and its bearing on Civilised Communities" in the International Journal of Public Health. A further article dealt with "Empire and Colonial Tuberculosis."

He was also the author of numerous scientific contributions to the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS and published, under a pseudonym, verses and sketches in *Blackwoods* and elsewhere.

He became the Editor of the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, in succession to the late Sir William Horrocks, in January 1941. Sir Alexander Hood, in an appreciation written on his retirement in November 1944, said "during the past three and a half years (a very difficult period) has maintained the high standard of our Journal and enriched its pages from his wide knowledge and experience. Those who have worked with him during that period have found him a delightful colleague and a very wise and kindly counsellor."

Lyle Cummins was one of the fast-diminishing band of officers whose service both in Peace and War went back to the days before the formation of the Royal Army Medical Corps. In after years when his work as a Civilian Professor had brought him well merited recognition by his colleagues he never lost his interest in the welfare of the Corps. It was a source of great pride to him that that association going back to the year 1897 was revived by his Editorship of the Journal up to the year 1944, some 47 years later. Almost up to that time he had been working on some research work in the laboratories at the College.

He was a quiet, kindly man, rather diffident and shy when he visited the mess during the war years to find so few of his contemporaries there to greet him. But his interest in current happenings was acute and he may be best remembered, in the words of Sir Alexander Hood, as "a delightful colleague and a very wise and kindly counsellor."

Lieutenant-Colonel BARRY ALEXANDER CRAIG, R.A.M.C. (Rtd).

LIEUTENANT-COLONEL B. A. CRAIG died in the Royal Sussex County Hospital on April 30, 1949. He had been living in retirement at Beech Cottage, Burgess Hill, Sussex.

Colonel Craig was born on April 25, 1873, and became a Civil Surgeon on December 4, 1899. He was later commissioned as a Lieutenant in 1902—was promoted Brevet-Lieutenant-Colonel in January 1917 and Lieutenant-Colonel in December 1923. He retired in November 1925. After his retirement he was employed as Medical Officer in charge of Troops at Leicester and Lulworth.

He was on active service in France and Belgium from December 3, 1917, to October 10, 1919, was mentioned in Despatches, received a Brevet of Lieutenant-Colonel, and the British War and Victory Medals.

**Lieutenant-Colonel MAYNARD CRAWFORD, O.B.E.,
R.A.M.C. (Rtd.)**

WE regret to announce the death of Lieutenant-Colonel Maynard Crawford which took place on March 14, 1949.

Lieutenant-Colonel Crawford was born on June 16, 1875. He took the F.R.C.S.I. in 1903.

After employment as a Civil Surgeon for over two years he was commissioned as a Lieutenant on January 31, 1903. He designed the original Syphilis Case Sheet at Woolwich in 1903.

In the South African War he took part in operations in Cape Colony, Orange River Colony and the Transvaal, being awarded the Queen's Medal with four clasps.

In the First World War he served first in the Hospital Ship *Anglia* visiting France, Egypt, Salonika, Madras, and India. Later he served in France and Belgium. He was mentioned in Despatches; awarded the O.B.E. and also the French Silver Medal "*de la Reconnaissance*." He was promoted to Lieutenant-Colonel on January 7, 1926, and retired on June 16, 1930.

After his retirement he became a Surgeon in the Blue Star Line serving as Surgeon in S.S. *Avila Star* until 1942 when that vessel was sunk by torpedo attack. After a lengthy swim with a leg broken in three places, he spent three days in an open life-boat. Finally he was rescued by a Portuguese destroyer.

Major WILLIAM HENRY JACKSON, R.A.M.C. (Rtd.)

MAJOR JACKSON died at his home in Caernarvon on February 20, 1949. He was born in Dublin on August 1, 1864, the son of Deputy Surgeon-General Sir Robert William Jackson, Kt., C.B. He graduated M.B., B.Ch., B.A.O., in 1887, at Trinity College, Dublin, taking the D.P.H. the same year. He proceeded M.D. in 1892.

He became a Surgeon, later Surgeon-Captain on July 29, 1890. He was employed on Special Plague duty in India in 1899 and 1900, his work being commended by the Government of Bombay. He was promoted Major in 1902 and retired in July 1910.

During the war in South Africa—1901–1902—he served in Transvaal and the Orange River Colony gaining the Queen's Medal with four clasps.

He had been Medical Officer in Charge of Troops at Lichfield and Weymouth from January 1911 to June 1915 when he was re-employed on the Active List. From then on he saw service in Gallipoli; Egypt; British, German and Portuguese East Africa; Nyasaland and Northern Rhodesia; Persia and in a hospital ship in the Persian Gulf up to February 1920 when he found himself in charge of the Military Hospital, Clonmel, Ireland.

At the start of the 1939 war he was 75 years of age, nevertheless he volunteered for duty as Medical Officer of the Ninth Battalion R.W.F. Camp at Caernarvon which post he relinquished to act as Ship's Surgeon on M.V. *Glenapp*, carrying munitions via the Panama Canal and the Dutch East

Indies to Singapore. The vessel had to return hurriedly via Australia and the Cape of Good Hope to England following the fall of Singapore.

Major Jackson spent his last years peacefully at Caernarvon where he was the County Controller for the Red Cross Society.

He was an honorary member of the British Red Cross Society and the Venerable Order of the Hospital of St. John of Jerusalem.

Notices

OFFICERS who contemplate holidays—or settling—in Eire may obtain information from Captain Maurice Parsons (late Camerons) who writes enthusiastically as to the climatic, dietetic and sporting conditions in what he regards as a delectable spot. He is prepared to take either a temporary or a permanent boarder himself.

If anyone is interested he will be happy to give full particulars.

His address is

Captain MAURICE PARSONS,
KELLS,
CORDFIN,
Co. CLARE,
EIRE.

Proposed Presentation of a Portrait TO

SIR EDWARD MELLANBY
G.B.E., K.C.B., M.D., F.R.C.P., F.R.S.

THE Director-General has sent a donation of £10 10s. from the Director-General, Army Medical Services, and officers of the Royal Army Medical Corps, to a fund which has been opened to present Sir Edward Mellanby with a portrait of himself on his retirement from the Secretaryship of the Medical Research Council.

The great development of the Council's activities during his term of office and the invaluable help given to the Medical Directorate during the war years need not be detailed here.

This presentation has provided an opportunity of making some tangible recognition of the services rendered to medical work in the Army in the many theatres of war by the Medical Research Council under the wise guidance of Sir Edward Mellanby.

Reviews

EARLY RECOGNITION OF DISEASE. "THE PRACTITIONER HANDBOOKS." Edited by Sir Heneage Ogilvie, K.B.E., D.M., M.Ch., F.R.C.S., and William A. R. Thomson, M.D. London: Eyre and Spottiswoode (Publishers) Ltd. 1949. Pp. 134. Price 10s. 6d.

The work submitted in this book compels a focus on those features of diseases by which they may be recognized early in their course. These may be symptoms or signs or evidence found on the application of such accessory methods of investigation as radiology or biochemistry. To set aside the classical descriptions of diseases in their established forms and indicate the early changes in the patient which may lead to their recognition is work for which manifest need exists, and as presented in these collected contributions to *The Practitioner* now assembled in this book the work is deserving of attention and interest. The subjects are simply and briefly discussed, they make pleasant reading and provide a useful guide to consideration of how cases are likely to present and to the foundations on which a diagnosis can be based. Two articles, one by Professor Alan Moncrieff on "Diseases of Childhood" and one by Professor Arnold Sorsby on "Diseases of the Eye" have been added to the original series to give completeness.

J. B.

SKIN DISEASES IN GENERAL PRACTICE. By F. Ray Bettley, T.D., M.D., F.R.C.P. London: Eyre and Spottiswoode (Publishers) Ltd. for *The Practitioner*, 1949. Pp. 260. Price 21s.

The scope of this work is narrowed down by the author to embrace only such dermatological conditions as present to the general practitioner as everyday problems. A reference to the index finds no mention of such conditions as the erythemata and lupus. The compensatory advantage is readily apparent on reading the four chapters devoted to eczema. They give a clear, comprehensive and readily assimilable survey of this subject in which no detail of value in management is omitted. A similar standard is maintained throughout. The work is illustrated with many excellent photographs, and an Appendix gives a list of about 700 potential skin irritants with data of concentrations and vehicles required for patch testing. The book achieves the purpose the author sets himself and conveys the requirements of descriptions, diagnoses and treatment necessary for the general practitioner to recognize and to treat with skill the skin diseases that present themselves daily.

J. B.

Extracts from the London Gazette

(1) HONOURS AND AWARDS

(a) R.A.M.C. and late R.A.M.C.

(i) *Birthday Honours* (L.G. 9.6.49)

K.B.E.

Lt.-Gen. Neil Cantlie, *C.B., M.C., M.B., F.R.C.S., K.H.P.*
C.B.

Maj.-Gen. K. A. M. Tomory, *O.B.E., M.B., K.H.P.*
C.B.E.

Brig. David Fettes, *O.B.E., M.B., F.R.C.S.Edin., K.H.S.*
O.B.E.

Lt.-Col. (Temp.) (Q.M.) H. Tottle, R.A.M.C.
M.B.E.

Maj. (Q.M.) G. E. Box, R.A.M.C.

Maj. (Miss) R. M. D. Morrell, *M.B., R.A.M.C.*
B.E.M.

No. 7262381 S/Sjt. Eric Gordon Richards, R.A.M.C.

(ii) *King's Honorary Physician*

Maj.-Gen K. A. M. Tomory, *C.B., O.B.E., M.B.,* late R.A.M.C., is appointed Honorary Physician to The King, 12th May 1949, vice Maj.-Gen. W. Foot, *C.B., M.C., M.B.,* who retired on that date.

(iii) *The Grand Priory in the British Realm of the Venerable Order of the Hospital of St. John of Jerusalem*

The King has been graciously pleased to sanction the following Promotions in, and Appointment to, the Venerable Order of the Hospital of St. John of Jerusalem:

As Officers (Brothers)

Brigadier O. C. Link.

Colonel J. M. Ryan.

Colonel F. McL. Richardson, *D.S.O., O.B.E.*

Lt.-Col. K. G. W. Saunders, *O.B.E., F.R.C.S.*

Major J. R. Hamerton, R.A.M.C., T.A.

(b) *Q.A.R.A.N.C.*

Birthday Honours

M.B.E.

Junior Commander Alice Margaret Hey, *A.R.R.C.*

R.R.C.

Prin. Matron Evelyn May Rixon, *A.R.R.C. (Retired)*

(2) PROMOTIONS

(a) R.A.M.C. and late R.A.M.C.

(i) Lt.-Cols. from R.A.M.C. to be Cols.:

T. F. M. Woods, *O.B.E., M.D., M.R.C.P.* 6 June 1949

(ii) Majors to be Lt.-Cols.:

J. A. MacDougall, *O.B.E., M.D.* 22 May 1949

A. C. Cox, *O.B.E., M.B.* 22 May 1949

A. Gleave, *M.B.* 6 June 1949

(iii) Quartermasters:

Capt. (Q.M.) A. W. Grevatt to be Maj. (Q.M.) 4 June 1949

(b) R.A.D.C.

Majors to be Lt.-Cols.:

O. E. Howell 2 June 1949

(3) APPOINTMENTS TO SHORT SERVICE COMMISSIONS

R.A.M.C.

- | | |
|---|-------------|
| (i) From Emergency Commissions to be Capts.: | |
| N. L. Paros, M.B. (retaining present seniority) | 30 May 1949 |
| T. J. Ryan (retaining present seniority) | 31 May 1949 |
| I. M. Crañ, M.B. (retaining present seniority) | 1 June 1949 |
| (ii) From Emerg. Commn. to be Lts.: | |
| C. M. C. Smelt, M.B. | 26 May 1949 |
| J. R. Watson, M.B. | 2 June 1949 |
| (iii) To be Lieutenant: | |
| David George Bushman Riddick | 29 May 1949 |

(4) RETIREMENTS

- | | |
|--|------------------------------|
| (a) R.A.M.C. and late R.A.M.C. | |
| Col. W. W. S. Sharpe | 24 May 1949 |
| Lt.-Col. G. F. Harrison, <i>M.B.E.</i> , M.B. (disability) | 30 May 1949 |
| Col. D. T. M. Large, M.B. | 1 June 1949 (Hon. Brig.) |
| Capt. (W/S.Maj.) J. B. Headley-Blythe (disability) | 16 June 1949 (Hon. Maj.) |
| (b) R.A.D.C. | |
| Maj. H. A. W. Lincoln (S.S. Commn.) (receiving a gratuity) | 20 June 1949 |
| (c) Q.A.R.A.N.C. | |
| J. Comd. E. M. Mollet, <i>R.R.C.</i> | 3 June 1949 (Hon. C. Comd.) |
| C. Comd. E. M. Rixon, <i>A.R.R.C.</i> | 21 June 1949 (Hon. C. Comd.) |
| J. Comd. E. E. Barker, <i>R.R.C.</i> | 20 June 1949 (Hon. S. Comd.) |
| J. Comd. M. Appelbee, <i>A.R.R.C.</i> | 20 June 1949 (Hon. J. Comd.) |
| C. Comd. S. E. A. Hardy (disability) | 27 June 1949 (Hon. Contr.) |
| S. Comd. M. Booth, <i>R.R.C.</i> | 26 June 1949 (Hon. C. Comd.) |

(5) HALF-PAY

- | | |
|---|--------------|
| (a) R.A.M.C. | |
| Major J. Walsh, M.B., placed on half-pay on account of disability | 13 June 1939 |
| (b) R.A.D.C. | |
| Lt.-Col. W. P. Baxendine, <i>O.B.E.</i> , placed on half-pay of account of disability | 2 June 1949 |

(6) RETENTION ON THE ACTIVE LIST, SUPERN. TO ESTABLISHMENT

R.A.M.C.

Colonel D. H. Murray, M.B., late R.A.M.C., having attained the age for retirement, is retained on the Active List, supern. to establishment 6 June 1949.

EDITORIAL NOTICES

The Editor will be glad to receive original communications upon professional subjects, travel, personal experiences, etc.

Correspondence on matter of interest to the Corps, and articles of a non-scientific character, may be accepted for publication under a *nom de plume*.

All Communications or Articles accepted and published in the "Journal of the Royal Army Medical Corps" will (unless the author notifies at the time of submission that he reserves the copyright of the article to himself) become the property of the Library and Journal Committee who will exercise full copyright powers concerning such Articles.

A free issue of twelve reprints will be made to contributors of Original Communications, and of twelve excerpts in the case of Lectures, Travels, Clinical and Other Notes. Such free reprints or excerpts will, however, owing to the shortage of paper, only be sent to those specifying their wish to have them, and a request for them should accompany the article when submitted for publication, the request being made in the form of a note at the foot of the manuscript.

Reprints or excerpts, additional to the above, can be furnished on payment if specially ordered at the time of submission of the article for publication.

Communications in regard to editorial business should be addressed—"The Editor, JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, A.M.D.2, War Office, London, S.W.1."

MANAGER'S NOTICES

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ASSISTANT EDITOR

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MANAGER

MAJOR W. R. WEST-WATSON, M.B.E., R.A.M.C.

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Journal of the Royal Army Medical Corps.

FOREWORD

In this number we are able to publish, by permission of the Director-General, reports of some of the papers read at a recent Medical Exercise.

Other articles will appear in a future number.

In his Opening Address the Director-General, Lieutenant-General N. Cantlie, *C.B., M.C., F.R.C.S., K.H.P.*—whom we are now happy to address as Sir Neil Cantlie, *K.B.E.*—said :

Exercise "Medical Bamboo" is based on the CIGS's exercise "Bamboo" which was held at the Staff College, Camberley, during the summer of last year, and it was the first Medical exercise of its kind.

Never before have we had assembled for such a purpose, such a gathering of senior officers of the Army Medical Services as we have today. He was especially glad to welcome the members of the Q.A.I.M.N.S., the R.A.D.C., our colleagues from the American Army Medical Corps, the Royal Navy and the Royal Air Force. Modern warfare is so essentially a joint allied and joint services operation that no exercise of this nature could be successfully undertaken without the presence and assistance of our American colleagues and our colleagues of the Royal Navy and the Royal Air Force.

The object of "Medical Bamboo" was to collate the experiences of the past and to relate them to developments in medical science and to medical organization which will exist in 1951-52. He felt that we have such a wealth of war experience in the R.A.M.C. today that it would be wrong if he did not ensure that these experiences and the lessons learnt were brought out by discussion and recorded for the benefit and guidance of those who will follow us.

The organization of "Medical Bamboo" had been done by a team of officers, the majority of whom have had considerable battle experience in the terrain which is the background for this exercise—Malaya, Burma and Thailand. The team, under the leadership of Colonel MacAlevey, would portray in playlet form the medical organization and planning of a seaborne assault on Tavoy, the assault itself and the follow up and the advance down the railway corridor from Moulmein to Bangkok.

The D.G. then welcomed those officers who would deliver papers on various

subjects including Brigadier Bruce who had come all the way from Edinburgh and Brigadier Marriott of the Middlesex Hospital.

He was most anxious that every one present would contribute to the discussions and the more heated these became the greater would be the success of the exercise.

The Director-General's Closing Address

The D.G. said we had now come to the end of exercise "Medical Bamboo," and he felt that they had all learnt a great deal. To ensure that it is not forgotten, he proposed to produce a record of the exercise.

The employment of the Medical Forward Treatment Unit must be given consideration. What is its future role to be? Should it remain as at present? Should it carry a surgical potential or should it revert to its original role of that of Malarial Forward Treatment Unit?

The use of the Red Cross must be considered. Should field medical units display the Red Cross irrespective of their tactical position in the field? He felt that this decision must be made by formation commanders and would depend on the type of enemy confronted, the terrain, and the tactical disposition of the medical units.

The question also arose as to whether aircraft used to evacuate battle casualties should have Red Cross markings? At present it is most unlikely that aircraft will be placed at our disposal for our sole use, which would be necessary if aircraft were to be so marked. The question is to be brought before the international meeting to be held in Geneva in March on the Geneva Convention, and it may be decided that aircraft evacuating casualties will be required to fly at certain altitudes and along specified routes.

As regards sanitation, the D.G. felt that a lot could be done to mechanize field sanitation. Mechanical diggers were required to dig deep trench latrines and for bore-hole latrines. Augers driven from the engines of vehicles similar to Water Cart pump were wanted. He hoped that the School of Hygiene would do experiments.

The D.G. then thanked the Commandant of the Army School of Hygiene and his officers; also the lecturers, many of them civilian doctors, who had come from a distance. They are busy men, and the fact that they had found time to talk to us, speaks highly for the spirit amongst ex-members of the Corps.

Finally he wanted to thank Colonel MacAlevey and his team. To them was due the credit and the highest praise for the success of the exercise.

Original Communications

SURGERY IN FAR EASTERN THEATRES OF WAR

BY

Brigadier J. BRUCE, C.B.E., F.R.C.S.

(Report of a paper read at Medical Exercise "Bamboo")

THE craft of the Surgeon, and the science of surgery have always derived a compelling stimulus from the impact of war. In bygone days and those not so long past, the masters of the craft were to be found in the wake of armies, for the torn flesh of the battlefield provided a recurring opportunity of experiment and observation. "I would remind you," said Clifford Allbutt, "how large and various was the experience of the battlefield, and how fertile the blood of warriors in rearing good surgeons."

In this sense, surgery owes a debt to war; and in part-payment, I am privileged and honoured by the opportunity of addressing this distinguished audience.

I have, I fear, no very profound or unusual information to place before you; but since my subject—Surgery in Far Eastern Theatres of War—can only be considered against a background of past events, my observations may have some of the virtue which attends experience recollected in tranquillity.

It is not without its dangers to lay overmuch stress on previous happenings; indeed, one of the salutary lessons of the war was the fallacy of Disraeli's dictum that a "precedent embalms a principle"—the danger of assuming that what was good in one campaign must needs be the proper course in the one following, or the one next year. Nevertheless, on mature reflection, I am convinced that some of the circumstances of the Burma Campaign, and the demands they imposed on an inadequate medical service, are worth recall and review as an insurance against future events.

The technical details of field surgery differ little wherever the battleground; on the other hand, the technique of planning a regional military surgery for the scattered battlefields of global war is a recurring and unsettled problem. And the surgical needs of any Campaign must be deduced from the recorded geography of the terrain over which it is to be fought, and from the contemporary trend of battle tactics. I propose, in the main, therefore, to examine the manner in which general surgical principles and policy may have to be modified to suit the particular local conditions of an Eastern setting, and to serve a type of fighting which has been—and is likely to be again—a singular one.

My concern, of course, is not with surgical detail; and, so that there will be no confusion of issues, I must set forth the surgical principles to which I subscribe.

PRINCIPLES OF WAR SURGERY

As a surgeon, I believe that the first aim of *all* surgery is the rescue of the maximum number of lives. Military surgery is no exception to this rule; indeed, the promise of it is implicit whenever amateur soldiers are called to battle; and this obligation was magnificently discharged in the last war. I use as an illustration the campaign I know best—but only because I know it best; and in a day when the arts of destruction had been brought to considerable perfection, it is a matter of pride to recall that, out of every 100 wounded men who lived to reach the Field Ambulance of the 14th Army, some 95 ultimately survived.

I believe that several factors contributed to this end; but I am humble enough to concede that increased surgical prowess, or outstanding technical advances, played no significant part in what was no less than a triumph and an achievement.

We must look elsewhere to apportion the credit adequately and well and to one circumstance in particular I am privileged to pay tribute here; that is to the readiness of the administration to adapt their plans, and to balance their holding and evacuation policies in such a way that the changing demands of a sometimes voracious clinical service were almost invariably satisfied.

“Battle casualties die from three causes—from hæmorrhage, from shock and from infection: from *hæmorrhage* in the first two hours, from *shock* in the first two days, and later, from *infection*” (Ogilvie). This is the argument for early surgery and all its adjuncts; and the development of a Forward Surgical Service in the late war represents one of the most substantial of the surgical contributions to the welfare of the Imperial Armies of Britain.

The need for early surgery is universally admitted; it is germane, however, to consider its implications still further before we assess in surgical terms the measures of a jungle campaign’s difficulties and disadvantages.

EARLY SURGERY IN TERMS OF TIME

It is obvious that, if we can be more precise about “early surgery”, if we can define it in terms of time—or of space—we will have a logical foundation on which to plan—and to modify—any military surgical service. I suggest we should look at it for a moment in terms of the common types of battle casualty.

Take first the *belly wound*; for here the problem is comparatively simple. The most urgent of the abdominal wounds are those with continuing intra-abdominal hæmorrhage. Resuscitative measures may lead to a temporary alleviation of the profound shock, but without simultaneous surgery, it is a hopeless folly.

The other potent danger of the belly wound is infection and peritonitis: but, torn intestines do not leak much for some hours, and the peritoneum has a remarkable tendency to isolate infection by adhesion and localization. The problem presented by belly wounds, therefore, is twofold. In the first place, there is the “bleeder” who must be brought to operation certainly within six hours: the other, the potential “peritonitic,” who can be left for a

longer period—but only provided that, by waiting, he can be brought to skilful operation in better environment within a further six hours.

In chest wounds, the dangers are also simply stated ; for the *open wound—the sucking wound*—demands immediate closure to arrest a highly dangerous physiological state ; and the massive bleeding wound needs early operation, to combat a shock that is gravely accentuated by anoxia, when the lung is out of action and the cardiac function disturbed by the accumulation of blood in the chest cavity. Again, the ideal is surgery within a few hours.

Pass now to the bread and butter of forward surgery, *the limb wounds* which comprise the bulk of the military surgeon's work. Here I must single out for special mention, those wounds with massive muscle destruction which produce in so short a time an overwhelming state of collapse. The mechanism of the shock is still not clear ; but what is clear is the only way to circumvent it, and that is by urgent removal of the damaged muscles—or even of the mangled limb—while all the resources of resuscitation therapy are rigorously deployed. This too, is a matter of a few hours, and of the highest surgical priority.

The lesser wounds of bone and joint offer a more difficult exercise in surgical strategy. The danger now is not an immediate one ; it is the later development of infection which must be circumvented. The problem is one of some magnitude ; for the frequency of such wounds gives them an immediate military and a remote national economic importance. It is, therefore, all the more necessary to relate their management to the factor of time.

Common teaching before the war defined a time lag of 12 to 24 hours before infection became established in wounds. This was based very largely on the experience of the 1914–18 war, for by 1917, British surgeons had demonstrated that war wounds promptly treated in forward units by formal excision, and kept covered, did not become infected and could safely and successfully be stitched after a suitable interval.

The introduction of powerful bacteriostatic agents naturally offered a hope that the period of safety might be lengthened ; and we must enquire if this is, in fact, the case. It would prove of inestimable advantage if we could safely postpone elective surgical treatment ; not only would it cut down the amount of surgery in the forward units, but it would ensure the bulk of our war wounds were treated under the most favourable conditions.

A review of the experiences of the last war has convinced me that we cannot safely advocate revision of our policy in respect of these lower priority wounds. Systemic penicillin and sulpha therapy have unquestionably proved their ability to defend against the spread of some forms of cellulitis or to prevent or to limit septicaemia : they both have a disappointing effect on the local state of the unexcised wound ; and local applications are not only ineffective, but when they crust like the sulphonamides, they may act as foreign bodies or as plugs. And not one of our bacteriostatics is comprehensively lethal ; so that if our chemists cannot evolve something more potent and less selective, we should ensure in planning for the future that the “golden” period for wound excision is kept under twenty-four hours. I make a plea for this, and any

attempt to depart from this principle with our present resources should be submitted to the closest professional scrutiny.

During one phase of the Burma Campaign an experiment was instituted which has some bearing on this problem. It was suggested—justifiably by the long and difficult lines of evacuation and the relatively paucity of forward surgical units. As soon as possible after wounding, the skin around the wound was shaved and cleansed; the wound was then anointed with sulphonamide cream and covered with a sulphonamide-impregnated pad kept in place by an elastoplast bandage.

The trial was under way when I joined as Consulting Surgeon; and I had to bring it to an end very soon. The wounds did very badly; and in several cases the circular elastoplast produced ischaemic necrosis when reactionary traumatic or inflammatory cedema supervened.

The experience left me with the firm conviction that whatever place bacteriostatics have *after* wound excision, they are certainly no substitute for prompt forward surgery.

These then are the aims of forward surgery—to bring the belly wounds, the grave chest wounds, the massive limb wounds to operation within a few hours; and to provide the opportunities of skilled excision for as many as possible of the wounds not immediately lethal within twenty-four hours.

I have deliberately stated these aims in terms of time and surgical principle, rather than in terms of medical units or systems of evacuation—a problem of greater complexity, but perhaps of greater interest to you. To the surgeon, the name of the particular unit at which the forward surgery is executed is of little significance. I believe that the Casualty Clearing Station is the farthest forward unit which can supply all the high demands of major, first-class surgery; and whenever and wherever casualties can be brought there in the optimum time, this should be the basis of our surgical policy. It resolves itself into a question of *evacuation* therefore; and it is at this point that I can conveniently turn again to the Far Eastern theatres of war, for here tactical expedients, scarcity of roads and the unsuitability of what few there were for ambulance transport stated—and will always state—the problem of evacuation in its most difficult form.

Perhaps this is best illustrated by actual reference to the Burma Campaign.

THE BURMA CAMPAIGN.

The conquest of Burma developed in a series of phases. First of all, there was the advance through the jungle to the Chindwin, then the sweep over the plains to the Irawaddy, the crossing of the river, and the descent on Rangoon.

Surgically speaking, the *jungle phase* was the more interesting, and the more exacting. Compact troop movements are, of course, impossible in jungle warfare; the essential feature of a jungle advance is the use of penetrating columns—a Brigade or more strong—which exploits old jungle trails or literally hacks its own new way forward. Casualties occurring at the head of the column have to be hand carried back to the supporting Field Ambulances;

but further evacuation, especially during wet weather, may literally be impossible. For the early part of the advance, native stretcher-bearers may be able to operate; but very soon a point is reached where even they are surgically uneconomic.

JUNGLE SURGERY

Under such circumstances, we constantly employed a modified mobile surgical unit to accompany the column. Its vehicles were left behind, and as a rule 8 or 10 mules were provided for the carriage of equipment; but sometimes we had to rely on human portage; on a man pack basis, 40-50 porters were required. Officers and other ranks carried their own packs, and marched with the rearguard of the column. Heavy equipment had to be abandoned for the time being, and the minimum of reserves carried since replacements and food were dropped by parachute.

The surgical environment was primitive for operating tents were too heavy for mule transport, and a theatre had then to be improvised from parachutes; and one of the first tasks of the team was to make provision for its own safety by "digging down."

As a rule the casualties arrived during the day and in the case of severe wounds the general condition was poor as a result of the arduous travel, fatigue, blood loss and dehydration.

Resuscitation presented, therefore, a difficult problem. Plasma and crystalloids were carried, but blood was only available by bleeding locally, a bad practice when the donors were also being subjected to the rigors of a jungle advance, and had almost as big a chance of being wounded.

It was difficult, if not impossible, to ensure regular evacuation after operation. The journey might be a matter of a few miles yet last several days; and in the wet season the task was usually impossible. On each advance, therefore, the surgeon was confronted with the problem of disposing of his patients. The obvious solution—to leave a detachment to nurse them, and bring them on when they were improved—was full of hazard—with enemy parties prowling about—and so wherever possible, the cases were carried forward with the unit until they were cured, or until the agreed "objective" was reached, and it was possible to arrange for evacuation by light aircraft from improvised air-strips.

These jungle teams were not concerned with priorities only. Indeed the high priorities were for the most part doomed; and the several examples we had of astounding survival after extensive intestinal resections carried out on the "hook" were the exceptions that prove the rule. The real function of the team was to ensure that the numerically more important lower priority wounds received prompt and proper surgical treatment and were thereafter so protected and immobilized that a minimum of harm attended their subsequent transport. The dividend was the high proportion that eventually reached the units behind so clean that secondary suture could be carried out without further delay. Fortunately, on such exploits, the casualty rate was seldom high, and the teams were not "stretched" surgically, a matter of some importance.

SURGERY IN FIELD AMBULANCES

You will note that I have avoided the topic of surgery in Field Ambulance unsupported by surgical personnel because I hope that we have done with this for ever. Military surgery is not to be regarded as a crude departure from accepted surgical standards, but rather as a development of the art and science of surgery in a specialized and significant way : and those who practise it must have undergone a strict training in its details and its disciplines. I can well understand the anxiety to do something—anything—for a gravely wounded man ; but he who embarks on this must be so schooled in its craftsmanship that, without haste yet without tardiness, he is able to deal with any injury he may find ; and he must be so familiar with the anatomical disposition of wounded parts that he does not inflict any further damage ; and he must be able to count on skilled anæsthesia.

Such considerations must be emphasized with some force in jungle campaigns where Brigades and their Field Ambulance disappear in the “ blue ” on foot for days or weeks. In such an event, I believe it is essential to include a surgical element in the medical support, but the use of a scaled down F.S.U. had “ administrative ” repercussions. The end of the “ hook ” left the unit often far separated from its transport, and the difficulty of joining the two were not inconsiderable. I suggest that, for future campaigns of this nature, we should evolve a *special team*—a “ *jungle team* ” if you like—which can tag along with its essential equipment on its “ head ” or on its “ back ” or by mule or sampan.

A risk implicit in the use of such teams is their use at a level too far forward for anything more than accomplished first aid ; and combatant commanders do not always understand the difference between adequate surgery and first aid. They can—and have before—been educated in this respect, just as they can be—and have been—disabused of the notion that the team is a sort of private toy.

I do not claim that this was an ideal surgical set-up ; it was far short of that, but it is an example of how the needs of jungle warfare were met with some success ; and it carries a hint of how to plan for future campaigns of a like nature.

FORWARD SURGERY IN THE SECOND PHASE

The fighting over the central plains and at the river crossings allowed the more orthodox use of medical units. But here again, the paucity of roads determined our complete reliance on air transport of casualties from the Divisional Field Ambulances to the rearward units at Corps Headquarters. Light aircraft were employed, and strips were quickly prepared close by the Main Dressing Station as soon as a Division set up its headquarters.

This arrangement has a serious drawback from the surgical point of view. The proximity to the fighting, and the consequent need for “ black out.” imposed a “ blank ” period of as much as twelve hours, during which flying stops and all casualty evacuation comes to an end. This was, and will be, a common situation and when it obtains, there is no option but to establish an “ Advanced Surgical Centre ” close to the forward air strip.

THE ADVANCED SURGICAL CENTRE

I have no experience of the Field Dressing Station but I have seen such a Centre admirably formed round a nucleus of the M.D.S. of a Field Ambulance, suitably reinforced by the attachment of Mobile Surgical and Transfusion Units. The number of attached units must depend on the casualty expectation rate, and I must plead for a sympathetic approach to the problem, for the task of such units, in Eastern warfare is likely to be particularly onerous. During the day, the Centre deals *only* with the high priority bleeding abdomens, chests, and massive flesh wounds, and severe burns—cases to whom even a light plane journey of an hour or so, might well prove fatal; but during the hours of darkness, the Eastern centre must treat as many of the more serious second priority cases as it can cope with. This entails regular all-night operating sessions of great magnitude, and often day sessions as well. For the most part, at least three, and possibly four surgical teams will be needed to share the day and night shifts, and at least two transfusion units. The chronic shortage of such units in Burma never allowed of a “safe” build up, but by the creation of “ad hoc” teams (and the employment of visiting consultants) we managed as many as four for the busiest centres during the battles of the Irawaddy bridgeheads.

The acceptance of this policy has certain obligations. It implies the holding—and nursing—of all patients—and especially belly wounds in whom evacuation after operation is disastrous. So that, wherever possible, Nursing Sisters must be sent forward—temporarily, when the situation is “safe” in the military sense. A kind of “flying squad” of nurses is the answer, but during lulls in the fighting, the members of such squads must be returned to a Casualty Clearing Station or an advanced hospital—for disciplining, if for nothing else!

I have never listed amongst the disadvantages of a really Advanced Surgical Centre the fact that it was necessarily parasitic on a Main Dressing Station, for with goodwill, energy, and some education, the symbiosis can be a happy one; and I am bound to say that in Burma, I gained a new impression, and a new appreciation of the possibilities, the flexibility, and the importance of the Field Ambulance. And I can recall with great admiration, a group of Main Dressing Stations supporting a British Division which would have been outstanding in a peacetime review at the Depot.

Our policy of establishing these Advanced Centres as the focal point of our forward surgery, was and may well be criticized. In my opinion, however, it had the supreme advantage of ensuring that a maximum number of wounded received definite treatment in the “golden” period and with the special limitations of Eastern campaigns, this is impossible if the main surgical emphasis is placed on the Casualty Clearing Station.

This is not, however, to decry the surgical importance of the Casualty Clearing Station. Indeed, I regard it as an axiom of war surgery that operative treatment should only be given forward of a Casualty Clearing Station if and when circumstances prevent the high priority cases from reaching the Casualty Clearing Station within six hours, and without undergoing grave further deterioration; and the second priority cases from reaching the Casualty

Clearing Station in 12-18 hours. In point of fact, during the daylight hours, our Casualty Clearing Stations were amply committed in treating cases left over by the Advanced Centres from the night before, as well as the fresh cases occurring, and being rapidly evacuated, during the day.

The further evacuation of the Burma wounded from the Corps medical formations to hospital level was only and entirely by transport aircraft; and if the second surgical ideal—delayed suture of the excised wounds—is to be fulfilled, it is essential to have a generous build up of hospitals at air-head. Even when this is possible, there are drawbacks to air evacuation. Unfortunately, air transport cannot work to a precise programme. The disappointment of spending the day on a stretcher at the landing ground, and then returning at dusk to the same medical formation, is very distressing to the wounded man, and not particularly good for his injuries. There is no doubt that, in a battleground in which hospitals at best are many hundreds of miles away, and road, train and sea transport rarely possible, the best solution is an air service at the entire disposal of the medical arm. This would be less capricious, though still to some extent conditioned by local meteorological and tactical considerations; and it would permit the training of a casualty evacuation service which paid more regard to the casualty's medical and physical comfort than was possible in the last war. This is a matter of greater moment in the East than elsewhere, for the fuselage of a Dakota becomes like a furnace in the twenty minutes it takes to load and get under way. Even lightly wounded deteriorate rapidly and the salt and fluid loss by sweating may amount to several pints in a matter of minutes.

SOME SPECIAL SURGICAL PROBLEMS

So far, I have been content to review the influence of geographical and tactical considerations on general surgical policy.

It is, I think, important also to recall a few of the more specific disadvantages of surgery in a tropical environment.

From the surgical point of view, the constant heat and humidity are both embarrassing, and the regulation of the heat controlling mechanisms, and the preservation of the fluid and salt balance pose problems of supreme importance in surgical work.

Dehydration.—Dehydration is indeed a millstone round the neck of every tropical casualty. Its evil influence is particularly pronounced during very hot weather preceding the monsoon when an active man can lose up to 16 litres of sweat in twenty-four hours. The fighting man is, therefore, invariably short of fluid when wounded. He may lie out in the sun before being picked up; his journey to the Dressing Station by hand carriage or jeep ambulance exposes him to a high temperature; when eventually he reaches an Advanced Surgical Centre he may have to undergo his operation in a tent like a furnace and be nursed in a post-operative ward like an oven.

The man who has sweated to the point of severe dehydration has lost salt as well as water and, in consequence, though his tissues may be parched, he has no sensation of thirst and lies uncomplaining. Indeed he may vomit ordinary

water, but unless very seriously ill, he will lap up saline, so that it is a wise practice to salinify all drinking water in forward units.

The administration of fluid must indeed become a ritual from the earliest possible moment after wounding and, when enough fluid cannot be given by mouth, it must be administered parenterally. Depletion of the fluid reserves invariably complicates the clinical picture of severe hæmorrhage and shock in tropical battle surgery, and even when the general condition of the wounded man appears to call for urgent blood infusion, a pint or two of saline, rapidly given as a prelude, may effect a miracle.

Heat Stroke.—Heat stroke occurs after operation sufficiently often to merit attention and I believe that some cases probably escaped recognition. The high fever, the headache, the mental confusion, fits or coma, simulated cerebral malaria, which could also complicate wounding or operation. In my experience, heat stroke occurred most often in association with late belly wounds, large flesh wounds or wounds already infected, and it is probable that the inhibition of the heat loss mechanism, with resulting absence of sweating, is due to a combination of dehydration, toxæmia and anæsthesia. Adjustment of the fluid salt balance, speedy operation with a minimum of theatre drapings, and the lightest possible anæsthesia, are all important factors in its prevention, and in very hot weather there is much to be said for the practice of having a drip saline running during the whole period of operation, in any case in which a general anæsthetic is administered. The addition of a fan—or fans—to the operating room equipment of mobile teams intended for service in the tropics is also desirable.

EFFECT OF CLIMATE ON PERSONNEL

Climatic conditions have another important effect. The work potential of surgical teams is considerably less than in temperate climates. The young surgeon, in his enthusiasm, does not always appreciate this, but the observer readily detects the insidious deterioration in judgment and technique which mark the limits of endurance. Theatre staffs—and that uncomplaining and faithful body of men, the Operating Room Assistants, are even more liable to fatigue, and surgeons do not always make allowances for the hours of preparation and cleansing which each operating session entails. I am convinced that, in tropical warfare, no theatre shift should exceed eight hours except on the very rarest of occasions and during the most strenuous of battles.

INTERCURRENT DISEASES

Endemic disease may also vitiate the results of tropical war surgery and we may include in this category the many septic lesions of the skin.

Skin diseases are common especially during the monsoon when opportunities for regular bathing are wanting and there is not much incentive to wash your clothes when you cannot induce them to dry afterwards. Intertrigo, septic scabies, impetigo, boils, indolent ulcers and prickly heat abound, and there is little doubt that they increase the risks of wound infection. Minor wound sepsis

is more frequent near and during the monsoon and the impression remains with me that the healing even of clean wounds at base establishments was retarded in the most humid season, though sometimes it was hard to disassociate a nutritional or constitution factor, for at such times loss of appetite and loss of energy and body tone were common.

Of the other endemic diseases, two are of considerable surgical importance. When battle is joined in highly malarious territory, any breach of the suppressive regime may well result in an overt attack of *malaria*. The likelihood of this is certainly increased by the trauma of wounding and by anæsthesia, and it is especially when a man is wounded that suppressive treatment is apt to be overlooked or neglected. For a time in the late Burma Campaign, it was almost an inevitable sequel for the battle casualty to develop frank malaria on the second or third day after wounding or operation, and the situation was, and may well be again, sufficiently serious to warrant the institution of a full course of treatment in all save minor wounds, and in all cases requiring a general anæsthetic. I may mention in particular that it was often difficult for young surgeons—and not so young, too—to decide when a post-operative rise of temperature was due to local wound complications: this led to unnecessary inspection of dressings and to the removal of plasters. Furthermore, the fever increases the difficulties, already great, of maintaining an adequate fluid balance; while the secondary anæmia predisposes to infection. For all practical purposes, these difficulties can be overcome by the adoption of a routine treatment course, and in cases in which the oral route is not acceptable as, for example, in abdominal wounds, the appropriate remedy should be given by injection.

A second disease of some surgical importance is *intestinal amœbiasis*. I know of several occasions in which operation on a wounded belly disclosed a grossly infected colon. Such cases were, of course, inevitably fatal.

NUTRITION OF THE WOUNDED

The maintenance of an adequate state of nutrition after wounding is a problem common to all theatres of war. Yet in the Far East, it is perhaps less easy to solve. In Burma, it was naturally more difficult and more urgent in the case of Indian troops, in whom religious prejudice and racial custom to a large extent dictate the dietetic habit. The precarious protein balance of the Indian soldier left him in no fit state to withstand the pronounced protein breakdown which inevitably succeeds injury, and if his wounds were serious, he could pass rapidly into a state of severe hypoproteinæmia.

It does not need elaborate biochemical tests to discover this. The patient obviously loses flesh; the eyes are sunken, the abdominal and cervical skin is slack, plaster casts become loose and the calves are wasted.

Severe hypoproteinæmia is a serious complication; it predisposes to infection; its continuance even in the absence of wound infection certainly delays healing, and from its adverse effects on general muscular efficiency, it delays the convalescence and the rehabilitation of the wounded man.

But protein loss is not confined to native troops; and though its effects are perhaps most obvious at base hospital level, the dissipation of the body

proteins begins within a few hours of wounding. The *reason* is not clear, but the *fact* has two important corollaries. In the first place, the diet of the fighting soldier should contain an ample protein fragment—and one sufficiently attractive to be eaten—a matter of some difficulty, perhaps, when everything is delivered by air. The second corollary is that the wounded, from the start, must be adequately fed.

And in this connexion—though it is not perhaps within the remit of this lecture—I must refer to a deeply rooted delusion—that a sick man will eat and digest only what he needs and that after operation a “light” diet is ample. In point of fact, a wounded man requires more protein than he does normally—a gramme of protein per pound of body-weight is a rough but fairly accurate assessment—but it requires considerable ingenuity to ensure that the seriously sick will actually consume this quantity. Both surgeon and Nursing Sister are apt to neglect this facet of the after-care of battle casualties; but *food* is a therapeutic measure every whit as important as gastric suction, or penicillin, and there is a paramount need in the forward areas for expert dietetic help.

The control of dehydration, the maintenance of nutritional status, the recognition of intercurrent endemic disease—these then are the special duties which an Eastern campaign imposes on its surgical personnel. On its administrative authorities—and especially on its Consulting Surgeon—it adds the responsibility of watching closely for the signs of mental and physical fatigue which indicates that the young surgeon is in need of relief.

I am afraid that this rapid and sketchy survey of War Surgery in the East does scant justice to the topic or to its audience. I trust it has not been uninteresting, or completely unprofitable; to me the preparation of it has certainly been of value. And it has left me with one impression which I must now pass on to you. I am convinced that one great opportunity was neglected. The Campaigns in Burma offered an incomparable chance of investigating many problems of shock in its relation to fluid and salt loss, to environmental temperature, and to other circumstances, problems of bacterial contamination in tropical wounds, and many others.

May I, therefore, conclude with a plea; a plea for early and adequate research facilities when war sweeps over new terrains. Who knows but that the future may demand a coral island surgery, an Arctic surgery, or a surgery of the Russian Steppes, and trained and comprehensive research teams early on the ground may resolve many present problems, as well as some that are yet to be posed.

I have already paid the sincere tribute of a temporary soldier surgeon to the sympathy and wisdom of his administrative colleagues of the late war. In conclusion, I must again thank you for this opportunity of resuming an association, and recapturing an experience which to me will remain a privilege and an honour.

MEDICINE IN FAR EASTERN THEATRES OF WAR

BY

Brigadier H. L. MARRIOTT, C.B.E., M.D., F.R.C.P., A.M.S.

Honorary Consulting Physician to The Army ;

Consulting Physician, India and S.E.A.C. Commands, 1942-45

I WISH to express my appreciation of the honour of being asked, as a civilian, to talk to such a distinguished Army audience. The presence of such men as Macalevy, Meneces, Officer, O'Dwyer and Sayers makes me wonder what I, who learned from them, can profitably say in their hearing. My remarks are submitted with humility and in the trust that any apparent dogmatism will be ascribed to the effort to attain clarity and not to presumption.

I shall speak chiefly of what seem to have been the main medical lessons of the Burma campaign. Before doing so, I wish to introduce certain considerations of a corrective nature.

It is our duty to learn thoroughly, and to profit from, the lessons of the last war. However, it is even more important not to learn those lessons so well that they restrict our mental outlook and prevent us from being ready to adapt ourselves to the probable realities of the next war which will almost certainly be utterly unlike the one just over.

What are the likely realities of the next war? We must make the imaginative effort to foresee them if we are to avoid the pitfall of "last-war-mindedness."

Where will such a war be fought? In attempting the answer to this question one needs a globe and a tape measure. It then becomes apparent that the most probable zones of conflict may be in, through, or over very cold regions. It may be a very "cold" war indeed and our tropical experience may not stand us in much stead. Perhaps we ought to be considering the problems of polar warfare.

What will be the character of the next war? No one really knows but we must attempt an intelligent guess if policy is to be based on what will be and not on what was. Two major characteristics seem certain: (a) Dominance by air forces, (b) Dominance of atomic weapons. Development of the potentialities of aircraft make it certain that air power will be of paramount importance. Certain consequences become inevitable: First, speed of outbreak of war. Within a matter of hours we may attack, or be attacked from, areas thousands of miles away. Armies will be airborne and may, within a single day, leave the homeland and be engaged on frozen Arctic wastes or in tropical jungles. The lesson is ready adaptability of mind and preparedness for immediate war anywhere. Land or sea lines of communication may have entirely to be re-

placed by air supply and air evacuation. How adapted are the existing establishments and equipment of medical units for such an eventuality ?

The atom bomb is and atomic weapons seem likely to render all our familiar apparatus of war obsolete. Ought we not to be making our main preoccupation study of the prevention and cure of the effects of these weapons ?

I trust that the mention of these corrective considerations—"glimpses of the obvious," perhaps they are—may be forgiven. I propose now to deal with my subject proper.

What are the main and stable realities of "Medicine in Eastern Theatres of War ?" I submit that they are :

(1) *The potential prevalence of disease.*

None of us with Burma experience needs the labouring of this point. We remember the colossal sick rates of 1942 and 1943 and the consequent paralysis of combat power. Without effective medical services major war is almost impossible in humid tropical regions.

(2) *The corollary is that in tropical warfare the medical service is the most important of all the branches of the armed forces.*

This truth was realized in Burma by General Slim and the other generals but soon new senior officers will arise and it may become forgotten. It is, I suggest, our duty in peacetime to keep aflame in the minds of combatant officers realization of the practical importance of the medical branch—not for its own aggrandisement but as a matter of simple duty to the men who may have to die if it fails.

(3) *The main disease hazards are few and now well understood.*

They are: Malaria; bowel diseases; skin diseases; scrub typhus; venereal diseases; infective hepatitis; malnutrition.

(4) *All these diseases are preventable. Their occurrence on any scale should be indefensible.*

Malaria can be stamped out by a combination of the older methods of personal protection (long sleeves, long trousers, nets) and mosquito destruction (draining, oiling, etc.) together with the new methods of paludrine-prophylaxis and DDT spraying.

Bowel diseases can be eradicated if field hygiene is good enough. I shall be interested to hear in the discussion if any better method of water purification than chlorination has been evolved. It was not safe against amoebic cysts or virus infections. Boiling seemed the only real protection. The Dutch Army's practice, suggested by the German Schuffner, of compelling men to drink only tea was a good practical way of ensuring boiling of water. If a man's water-bottle is inspected he can easily lie and say the water was boiled but tea can be detected at a glance and can hardly be prepared without boiling the water; also it is preferred by the men.

Skin diseases can cause terrific man-power wastage in hot and humid climates.

The chief of them are intertrigo, fungus infections, prickly heat, scabies and impetigo. The main preventive measures are the discarding of clothing (stripped to the waist) in daylight hours, ample facilities for the washing of clothing and bodies, and the *instant* treatment of any lesions at their earliest beginnings.

Scrub typhus is partly preventable by thorough application of the lessons learned in the Burma and Pacific campaigns. It seems likely that the newly discovered antibiotic chloromycetin may give a method of suppression comparable with mepacrine or paludrine suppression of malaria.

Venereal diseases can be prevented by propaganda and prophylactic measures which are well known.

Infective hepatitis caused much sickness in the last war. Probably the virus was in many cases swallowed and prevention of this method of infection entails application of the same hygienic measures as are needed to eradicate bowel diseases. Towards the end of the war came the discovery that the virus is frequently transmitted by infected syringes or needles used for subcutaneous intramuscular or intravenous injections. We now know what a tremendous amount of jaundice has thus been innocently caused by doctors, nurses and orderlies. I am sure that tens of thousands of cases of infective hepatitis in the Services have been due to syringe transmissions during the various prescribed inoculations. The inoculations were necessary but one wonders if, in fact, they caused more wastage than they prevented. The virus is very persistent in needles and syringes and infinitesimal amounts suffice to infect. Chemical disinfection is unsatisfactory. Possibly speakers in the discussion will state what regulations are now in force to prevent syringe jaundice. I am still seeing men as civilian patients who have recently been demobilized and who have developed infective hepatitis about two to three months (the incubation period) after a Service inoculation.

(5) *Hundred per cent prevention of these diseases needs very efficient Army hygiene.*

I am conscious that I am speaking here in the Army School of Hygiene and I hope it may be understood that any opinions I express are not uttered in any spirit of hostile criticism but with the constructive aim of more and better hygiene.

In the Burma campaign our preventive measures were for a long time pitifully inadequate. The chief reason seemed then, and in retrospect still seems, that the R.A.M.C. was too orientated towards the treatment of disease and too little towards its prevention. It is literally true that always less than one per cent of our personnel was devoted to hygiene while 99 per cent were engaged in treating diseases which need not have occurred. Mr. Churchill's great words, in another context, could most fittingly be applied : " Never did so many owe so much to so few."

May one plead for consideration of permanent deviation to prevention of at least 25 per cent of R.A.M.C. personnel. The trap is that the allocation of personnel tends to be worked out in peacetime to fulfil the clamorous needs, pressing on an undermanned service, for the treatment of sick. In peace

stations here and abroad the problems of field hygiene do not irresistibly compel attention and tend to sink into the background.

The carrying out of preventive measures by combatant troops will be proportional to the conviction of their importance obtaining in the minds of combatant officers and other ranks. Conviction and full co-operation are not secured by simple orders. Intensive education and training are required. I shall be interested if we may hear what place hygiene training takes in the training of non-medical troops.

In tropical warfare continuous hygiene propaganda is needed and I have before suggested "that a medical directorate in the tropics should have as one of its sections, perhaps the most important branch, a section of propaganda staffed by experts in all forms of publicity including film and radio."

(6) *Most of the main diseases are very rapidly curable if treated early.*

It is true to say that most of the main diseases, if treated *early* and efficiently, can be :

CONTROLLED	in ONE DAY.
CURED	in FOUR DAYS.
CONVALESCENT	in TEN DAYS.

Malaria can be quickly "cured" by mepacrine, paludrine or quinine though relapses of B.T. malaria may subsequently occur. The bacillary bowel diseases respond very rapidly to the sulphonamides. All the common skin diseases clear up very rapidly if treated before extensive. Scrub typhus, which was such a menace in Burma, now yields in one or two days to chloromycetin. There is evidence to suggest that chloromycetin may also cure typhoid. The venereal diseases can be brought under rapid control by penicillin. Only amoebiasis, infective hepatitis and malnutrition require treatment for more than a few days.

(7) *Therefore, most of the diseases do not require evacuation to the base. Forward treatment is what is needed.*

I wish most strongly to submit a plea for a radical change in outlook in regard to the disposal of medical (not surgical) sick in the field. Can we not scrap for ever the policy of evacuation as the main principle of disposal? Can we not instead plan to treat at least 80 per cent of medical casualties forward and only provide for evacuation of 20 per cent?

The principle of evacuation to base was a colossal handicap in the Burma campaign. Not only was it dead against the medical realities of the diseases concerned but it resulted in fearful disorganization of the fighting troops. Once a man got into the evacuation machine it was literally many months before he got back into the fighting area and then often not into his old unit. The effect on troops' morale was very bad. Such disorganization and demoralization is needless but it will occur again unless there is a change of mental attitude *now*.

Forward treatment can in many cases be carried out in the man's own unit

if the regimental officer is quick enough off the mark and starts treatment within a few hours of the man beginning to be ill. If movement out of the unit is needed then it should be to light mobile medical units at brigade or divisional levels of organization and geographical distribution.

- (8) *The principles of :* (a) *Possible almost complete prevention of disease, and*
(b) *Early forward treatment, demand revision of establishments.*

If these principles are true then they should mean drastic revision of distribution of personnel :

(i) *Quantitative :* There need to be far more officers and men engaged in hygiene duties. Do not let us again fall into the trap of working out the allocation of hygiene officers in the light of peacetime requirements or in the light of experience gained in such health resorts as the Middle East. Let us remember the lesson of tens of thousands of sick of the Burma campaign—men sick of preventable diseases. It may be that in peace so many men cannot be diverted to hygiene but *let the establishments at least exist for the mobilization of field units*. So far as curative units are concerned, I suggest that in future the allocation of personnel should be the lion's share to forward units and a relatively small proportion to base hospitals.

(ii) *Qualitative :* The qualitative distribution of personnel is even more important than the quantitative. In the Burma campaign far too many of our best men were located (to their own disgust) in base hospitals literally more than a thousand miles from the operational area.

The first pick of men as regards quality should go to hygiene duties. Above all medical men in the field, the hygiene officer needs to be a man of ability, drive and personality. He has to influence the combatants by persuasion and, if needs be, forthright speech. This cannot be done by men who, as men, do not command respect.

The second pick of men should be the regimental medical officers. A good R.M.O. can have tremendous effect on the positive health and fitness of his regiment and can by his own exertions, regarding hygiene and early treatment, reduce sick rates. We need a tradition that the R.M.O.s are the medical *corps d'élite* of the younger men. They should be majors. In a regiment a medical officer is on his own for better or worse. If he is good he will tackle his duties with vision and energy, if he is bad he will let things slide and his first idea will be to push off his sick to rear areas. Let the duds be in base hospitals where there are many seniors to control and coerce them.

In this matter may I utter a word of warning in regard to the danger of civilian "hospital-mindedness" and the creation of too many "specialists"—operating in base hospitals. The civilian consultant, with his high standard of technical knowledge, can be of great value in war but not if he is obsessed with hospitals and acts by diverting too much talent into them. He must see the picture, and his part in it, whole. "An Army exists to fight not to go to hospital."

DISCUSSION

In the discussion which followed, the *Director of Hygiene* said that water purification arrangements were adequate and pointed out that there was now an official general issue of the individual water purification outfit. Developments had been going on at the College in connexion with the production of a new type of sterilizing tablets (Chloramine B). This was proving very satisfactory and there was every hope of its replacing the existing halazone tablets with their detasting counterpart.

Millbank filter bags were a standard individual issue. For small parties of men there was the midget filter, which produced 10–15 gallons of filtered water an hour. For larger parties there was the larger size of portable filter. Apart from this there was the well-known larger scale mobile purification apparatus of various kinds.

The *Director of Hygiene* also stated that the question of ration scales was constantly under review and that the field service ration now authorized for the Far East was fully adequate.

With regard to the special point of dried milk raised by Brigadier Marriott he thought that this was included in the present field service scale (Note : It was confirmed later that it was included as a part of the milk ration but limited availability did not allow of the full amount of milk authorized being issued in this form). As regards ration packs, dried milk was used. It was mentioned that a special committee was sitting at the present time with a view to considering ration packs and any improvements required to them. The policy was likely to be one of concentrating on the twenty-four-hour and the ten-man packs.

As regards increasing the establishment of hygiene personnel, as suggested by Brigadier Marriott, the *Director of Hygiene* said that apart from other circumstances, the medical man-power question involved would be a difficult one. He did not, however, think that the necessity arose for more hygiene units provided that units made themselves responsible for their own hygiene arrangements with technical assistance and advice from the hygiene organization. He felt that the existing hygiene arrangements with their malaria control companies, apart from the field hygiene companies and field sanitary sections, were adequate but that improvements were wanted in intra-unit hygiene organization. This matter was under consideration.

Col. Officer referred to the question of evacuating the sick. He thought there was no need for sick to be evacuated and that the majority of them could be dealt with on the post, thus avoiding the loss of manpower and the probable posting of the soldier to another unit.

General Douse said that he had found that it was possible to evacuate sick and return them, eventually to their own unit. He agreed with Brigadier Marriott's suggestion that R.M.O.s should have higher rank.

Colonel MacAlevey thought that a light Hospital, something on the lines of a MFTU, was needed at Corps level.

Brigadier Bennett thought that sick, apart from battle casualties, should

be treated in the forward area and said that a lot of sickness could be avoided by treatment in a field hospital.

General Tyndall said that the Field Ambulance today, is, in essentials, the same as the old Field Ambulance and that surgical cases must be evacuated.

Brigadier Cameron said that in Normandy no one had time to go sick for the first few days. He added that the first sick cases were exhaustions, which threatened to become a problem. He further added that all battle exhaustions were treated on the spot as they were advancing. Forty-six per cent, he said, of those given medical attention were battle casualties ; the remainder were sick. He was of the opinion that we should treat as many cases as possible in the forward area.

General Magner said that in his experience the potential of holding sick was not as great in the reorganized field ambulance as in the old. He thought that in a war of this nature (i.e. in the Far East) because of the high proportion of sick to wounded, we ought to have a higher potential for holding sick.

The *Director-General* summing up said that he agreed that where possible we should treat as many casualties as possible in the forward area. The problem was the transportation of the necessary equipment.

He agreed with *Brigadier Marriott* in saying that we must not learn our lessons too well, i.e. base our policy for a future war on the previous one.

PSYCHIATRY IN JUNGLE WARFARE

BY

Major A. H. WILLIAMS

INTRODUCTION

PSYCHOLOGICAL problems in "Exercise Medical Bamboo" are, of course, closely interwoven with general medical problems. In the exercise narrative it is emphasized that the prevention of sickness is an operational matter, not just a medical one. In a far eastern tropical theatre of war somatic sickness supersedes battle stress as the main ætiological factor in psychiatric breakdown. For this reason the psychiatric services must be even more closely integrated with the general medical services than in other theatres where somatic illness is not so important.

The problems will be considered under the following headings :

- (1) Prophylaxis.
- (2) The type of breakdown.
- (3) Organization of Psychiatric Services.

PROPHYLAXIS

Screening.—Screening is mentioned in the exercise narrative as being a necessary preliminary to posting overseas. This will have been carried out in Britain by the ordinary selection machinery of the A.B.T.U. Cases of gross instability or mental deficiency should therefore not be encountered among British personnel. West Africans, East Africans, Gurkhas and Malays will include such cases of gross instability and dullness, unless selection procedures are applied to them too. The same selection tests as for British Troops cannot be used. In West African troops the Matrix test is of limited value. According to Dembovitz, the average score is 18. In Gurkhas, according to my own experience, the score is rarely above 10. The quality of the labour units from India is important as there are likely to be gross failures in mental health among them out of all proportion to the nominal strength of the labour force.

Training.—Training is important as a prophylactic reserve. In primary training is laid down the soldier's future attitude to the Service. Posting overseas should not be interpreted as a punishment or a banishment from the group in which the soldier has been happy and well adjusted. Good training gives a man confidence in his ability to cope with his own environment both internal and external. When *formations* or *units* are sent overseas the soldier does not change his social environment. Changes in geographical setting should be dealt with by giving the maximum amount of information about life in the

new land, how to keep fit, and of the main difficulties likely to be encountered. During the period of acclimatization and jungle training, preconceived fears about diseases, the jungle, the heat, etc., should be finally debunked, but the preliminary debunking should begin on the ship if security considerations permit. Reinforcements present social problems as they have lost their group and are likely to feel that their new unit is hostile towards them. The policy of posting reinforcements in platoons or at least sections, has a great deal to recommend it. Even a small friendly group helps the individual to adjust. In the Arakan the two British Battalions of 26 Ind. Div. differed markedly in quality and efficiency. One battalion did not bother to integrate reinforcements into the battalion. The 1st Lincolns had a special officer for the job of "Lincolnizing" reinforcements. The advantages of an undeveloped terrain, especially jungle country, should be stressed. The use of the environment as a protection instead of a hazard is an encouragement which promotes alertness and efficiency. The fact that primitive aggressive impulses can find more adequate expression in this type of warfare is important, but is better not mentioned. The inhuman qualities of the Japanese, their treatment of prisoners and difference in appearance from British troops, tend to diminish guilty feelings over the question of killing or maiming them. This is in contrast to the feelings arising over the battle with Germans and Italians.

Welfare.—Morale is best maintained by ensuring that the soldier does not have to fight a war on the domestic front as well as the battle-front. Of the two wars, that on the home front outweighs the battle against the Japanese as a factor in the aetiology of psychiatric breakdown.

Good welfare organization at home and in the operational theatre are essential and adequate liaison between them must be maintained.

The exercise narrative stresses the value of a rapid turnover of mail—this is vitally important in maintaining morale.

The period of overseas service is important. Two-and-a-half years was found to be the critical time after which domestic upheavals occurred; these were either of acted-out type, such as unfaithfulness, or the type in which separation anxiety increased to such a degree that the soldier or his wife, or both, broke down with a psychoneurosis or a depression. During the first six months overseas the soldier is suggestible, and easily falls a prey to morale-raising or morale-lowering influences. After about two-and-a-half years overseas he becomes discontented and a large increase in paranoid attitudes occurs.

Leave is relatively important to British Troops but is vital to Indians and Gurkhas, though the latter are satisfied with leave every two years. Home leave of the L.I.A.P. variety is a great mistake as the soldier's adjustment is grossly disturbed, and the fresh wound which occurs when he leaves his family and returns to the Far East is often fatal to his psychiatric adjustment.

Publicity and news, especially in the form of a Force Newspaper are morale-raising factors in that they foster group consciousness. Anything which emphasizes the links between the larger social milieu is good.

TYPES OF BREAKDOWN

Anxiety States.—In British troops Anxiety States are much the commonest type of breakdown amounting to 50–60 per cent of all psychiatric cases. They may be classified into Panic States and Battle Exhaustions as well as the classical picture of acute anxiety. The first and second of these types are precipitated by acute stress, the third by chronic stress. In “Medical Bamboo” the third type is likely to predominate, except during the most intense fighting, as the stresses of climate, jungle and mountain with rapid movements against an elusive foe, tend to produce types of anxiety state more like those seen in civil life. The exhaustions and panic states have an extremely good prognosis, the classical anxiety states a somewhat less good one.

Occasionally in the absence of conscious anxiety a man is sent to the psychiatrist by his platoon commander as he has panic dreams in a forward area and constitutes a threat to his comrades by giving away the position.

Psychomatic Illness.—Psychosomatic symptoms predominate in about 20–25 per cent of psychiatric breakdowns in British troops. Headaches, fainting attacks, dyspepsias, palpitations, dyspnoea on exertion, are the commonest symptoms. The prognosis is not so good as that of anxiety states.

Gross hysterias are quite uncommon in British Troops—amounting to only 6 per cent. The most important group in jungle warfare consists of men who complained of night-blindness, and stated that they could not participate in patrolling. The prognosis of hysterias in British personnel is not very good as the underlying personality is usually less satisfactory than the anxiety state.

In Gurkhas, gross hysterias predominate—aphoria and deafness being the commonest type of symptom. Hysterias in both Indians and Gurkhas do well as a rule. The total percentage of breakdowns in Gurkhas is likely to be very small. West Africans and East Africans are prone to develop hysterical conditions and in Gurkhas, Indians and Africans anxiety states are uncommon. Such anxiety states are in the more intelligent and educated Gurkhas, Indians and Africans.

Depressions occur in British Troops, Indian Troops and Gurkhas—feelings of unworthiness are prominent and suicidal attempts are common. The cases are evacuated to the Advance base centre and given E.C.T.

Panic states occur most commonly in young British Officers and in Gurkhas. There is no future for them in the operational theatre but the prognosis at base is good.

Schizophrenia is uncommon in British Troops but quite common in Gurkhas, Indians, West and East Africans. In the Africans, violence—even homicide is not rare. The schizophrenias of Indian and Gurkha troops seem to be considerably less serious from a prognostic viewpoint than similar states in British Troops. Many resolve within a few weeks at the corps exhaustion Centre and the majority recover after E.C.T. at the advance base treatment Centre.

Toxic psychosis is common in Indians, Gurkhas and Africans. It has a seasonal incidence as might be expected, being maximal during and just after

the Monsoon when malaria and water-borne diseases are most common. The ultimate prognosis is good but the cases may be written off as far as the campaign is concerned.

ORGANIZATION OF PSYCHIATRIC SERVICES

Divisional psychiatrists are essential in a campaign such as that envisaged in "Medical Bamboo" where communications are poor and divisions are often far from each other in time if not in space. The divisional psychiatrist is posted to Div. H.Q. under the ægis of the A.D.M.S. When active operations are not going on, the divisional psychiatrist should carry out further selection and morale investigations and should give lectures and talks on mental hygiene to R.M.O.s and combatant officers. He should get to know the fighting units as well as possible so that in action their particular problems will be understood.

In action he should set up a Divisional Exhaustion Centre of 20 beds with, or close to, an A.D.S. The best site is in the A.D.S. where the psychiatrist is likely to miss only a few cases. It is realized that a field ambulance is an evacuation unit and the policy of holding a score of psychiatric cases may present a problem to the field ambulance commander. This problem is best dealt with by giving the psychiatrist an establishment, so that he is not parasitic for nursing help and equipment, and by demonstrating that it is just as important to hold a psychiatric battle casualty well forward as it is to evacuate a serious surgical casualty. In some way the battle neurotics deteriorate as they proceed to base and their prognosis worsens. This is due to three factors; firstly, the battle neuroses are best treated before they have had time to become fixed and static, when the patient is suggestible. Secondly, it is important to keep a soldier in his own social group in which his morale recovers most readily. Thirdly, with each hour's journey towards the base the secondary gains from the neurotic symptoms increase.

The divisional psychiatrist carries out simple therapeutic procedures such as sedation, narcosis, narco-analysis, hypnosis and brief interpretive psychotherapy. Group treatment is desirable both from the viewpoint of saving time and because it reduces the isolating effect of neurotic illness. Good food and vitamins are powerful adjuncts to treatment. About 75 per cent of all cases can be returned to duty from divisional level. The relapse rate is about 10 per cent but even if one month's fighting is sustained, the therapeutic effort has been worth while.

The Corps Psychiatric Centre.—At Corps level there is a corps psychiatrist whose duties are to co-ordinate the work of the divisional psychiatrists and to organize a corps exhaustion centre, usually attached to a C.C.S. where more elaborate treatment can be given to the cases evacuated from Div. level and also to the breakdowns in Corps troops and L. of C. visits. Because of the dual role of the corps psychiatrist, it is desirable for him to have the help of a trainee or a graded psychiatrist who can take charge of the exhaustion centre while he goes on tour or is employed by the D.D.M.S. on specific projects.

At Army H.Q. there should be an adviser in psychiatry, who, under the direction of the Army Commander and the D.D.M.S. Army, should give help

on all questions of morale as well as advice regarding the psychiatric organization for the campaign. At the Advance Base Centre, either as a wing of a general hospital or on its own, should be an Advance Base Treatment Centre where cases evacuated from the Corps Centre can be held for treatment up to three months provided that the prognosis is thought to be favourable and a return to unit is expected.

Close to this Treatment Centre there should be an Army Selection Centre in which re-categorization and re-allocation can be carried out so as to conserve manpower as efficiently as possible.

DISCUSSION

In the discussion which followed, Brigadier Rosie, Director of Army Psychiatry, said that he believed that the Far Eastern Theatre was the only theatre in which Divisional Psychiatrists were used. He stressed the importance of early psychiatric treatment.

He thought that "morale" was a very misused term—quite a few people being under the impression that it meant recreational activities and facilities and other amenities. Morale, he said, did not depend on these things at all, the main ingredients of high morale being the group or team spirit.

Col. Officer thought that all Divisional Psychiatrists should have experience as Regimental Medical Officers before taking on their duties at divisional level.

General Dowse did not think Major Williams had laid enough stress on his talks to R.M.O.s. In his opinion they were extremely important people and as they were the men on the spot, could do much to check psychiatric cases at the outset.

He mentioned the Intelligence Tests for West Africans and said that he thought they were quite unsuited to their mentality. He also said that he thought that a large number of officers posted to these West African units were quite unsuitable and in some cases could not even speak their language. He thought that all officers and N.C.O.s posted to these units should be specially selected.

Col. O'Dwyer mentioned an experience in Delhi where a group of young officers, having been warned too vividly of the prevalence of disease, developed psychoneurosis.

In conclusion, the *Director-General* said that the late C.I.G.S. had expressed a wish that only specially selected personnel should be posted for service with West African units.

AIR EVACUATION (CLINICAL ASPECTS)

BY

Dr. A. V. OWSTON

Principal Medical Officer, Royal Aircraft Establishment, Farnborough

I REGARD this very kind invitation of the Director-General of Royal Army Medical Corps to me to say a few words to such a distinguished gathering of senior Medical Officers, as a very great honour indeed.

My subject of The Clinical Aspects of Air Evacuation of Casualties is based on practical experience during the recent war, together with a pool of knowledge which has been compiled from various sources. I do not speak as an expert—I would refer you to Wing Commander Bruce Harvey and others in this respect.

How far air evacuation of casualties may be practised, say, in these islands, remains, in my opinion, a question of doubt. Much, of course, depends on improvements of aircraft, especially in relation to taking-off and landing.

As we have just heard from Colonel Meneces in his excellent lecture, there were many types of aircraft modified and used as Air Ambulances during the recent war—Bombay, Ventura, Hudson and Dakota—to mention a few. But in my opinion the ideal aircraft for use as an Air Ambulance, for example, in these islands, should be small. Of course, a very large fleet of small aircraft would be required. The type of aircraft I have in mind is the "Ambulance Dove," which is now being produced by de Havillands at Hatfield. I would strongly recommend you, ladies and gentlemen, to look at this air ambulance. I do not think it would really be suitable for the Services, but it would, I suggest, serve as a splendid comparison. The "Dove" is equipped for the carriage of four stretcher cases, with seats for three doctors or nurses, and it has comprehensive equipment designed under specialized medical supervision. The stretchers are of the de Havilland design, made of welded steel tube, finished in white enamel and with canvas troughs. They are 6ft. 4½ in. long and 1 ft. 10½ in. wide, the projecting handgrips are telescopic to facilitate loading. Tests have shown that the stretchers can be lifted easily into the cabin without tilting, nor do they need loading equipment.

The upper portion of the inboard stretcher support may be folded down out of the way or removed by means of a quick-release pin when it is intended to carry the lower stretchers only. The rearmost top stretchers can be tilted fore and aft so that the patient's head or feet may be raised. In addition to the space occupied by the stretchers, there is ample room for the medical staff to move about the aircraft. In the cabin wall there is an oxygen attachment and power points for electric bed-warming pads. A warm air-duct runs the full length of the cabin and is controlled by the pilot. Three standard passenger-type chairs are fitted on the port side.

Blood transfusion equipment can be carried and stowed in standard containers used in normal hospital work. Although the first essential of a medical transport is to bring the patient as rapidly as possible to the full resources of a hospital, the importance of continuous treatment on the journey may sometimes be equally vital.

Preparation of Patients.—It is most important that patients should be prepared as fully as possible for the journey by air so that they will need the minimum amount of attention in transit. No one should be moved immediately after an operation or hæmorrhage. No case of shock should be moved until he has recovered. A light meal with limited fluids should be given an hour before emplaning. Bowels and bladder should be emptied at as short a time as possible before emplaning and a sedative such as bromide, chloretone, hyoscine or morphia should be given to the patient to help ensure a tranquil journey and to prevent air-sickness, which is so liable to upset other patients and become epidemic if the journey lasts a few hours. All patients should be as fully clothed as practicable to keep them warm. In temperate climates each should be provided with a hot-water bottle and this may be necessary even in warmer climates, depending on the altitude of flight. Long stockings have been found particularly useful in helping to keep patients warm during air transport.

Medical Care en route in the Aircraft.—This should be the responsibility of the medical staff accompanying the casualties. The attendants would deal with immediate wants, give first aid or hyperdermic injection or administer oxygen to patients, as necessary.

Selection of Type of Case suitable for Air Evacuation.—Generally speaking, only a small percentage of casualties can be evacuated by air and therefore particular care must be stressed in their selection. The guiding principles for this are, in order of priority :

- (a) Rapid transfer of cases requiring special treatment to appropriate centres, e.g. burns, facio-maxillary, head injuries and orthopaedic cases, especially where speed is likely to make all the difference to the success or failure of the treatment.
- (b) Humanitarian considerations likely to effect the morale of the Forces and of course, the civil population.

A sound decision as to which cases require early evacuation is of prime importance. It is helpful, therefore, to give lists of types of cases considered suitable and unsuitable respectively for air evacuation. These lists were compiled as a result of practical experience in the recent war.

A. CASES SUITABLE FOR AIR-TRANSPORTATION

As far as possible, these have been arranged in order of priority :

- (i) Facio-maxillary injuries.
- (ii) Burns, especially of hands and face (after shock has been overcome).
- (iii) Perforated wounds of globe of eye, particularly those containing foreign bodies.
- (iv) Fractured limbs.
- (v) Head injuries where down to the bone.

- (vi) Pelvic and spinal injuries, after encasing in plaster.
- (vii) Empyema, after aspiration.
- (viii) Tuberculosis of lung (not if hæmoptysis is present).
- (ix) Enteric and dysentery, possibly with a view to lessening risk of infection in the field.

(i) *Facio-maxillary injuries*, including fractures of the lower jaw, require early and special treatment. These cases are not necessarily associated with severe shock unless there is also serious head injury, such as fracture of the skull or concussion, in which circumstances treat as for head injuries.

(ii) *Burns*.—Priority should be given to burns of the hands and face, but all burns, if possible, should be evacuated by air before secondary shock occurs, that is to say, within the first forty-eight hours. If burns are severe in degree or in extent, the patient should be retained for twenty-four hours for treatment of shock with plasma (or serum). As a rule, a minimum of 2 pints (1,200 c.c.) is required; much more than this can be given with safety over a period of four to eight hours, viz. four to five pints (2,400–3,000 c.c.). If no previous local treatment has been given, first aid should consist of cleansing with saline, followed by the application of gauze soaked in a solution of sodium bicarbonate.

(iii) *Eye Injuries*.—Perforating injuries of the globe, especially if the presence of a foreign body is suspected, or prolapse of the iris, need early evacuation.

(iv) *Fractures of Limbs and Injuries of Joints*.—Injuries of upper extremities can usually be evacuated without delay and can be sent as sitting patients. *All fractures must be efficiently immobilized in splints or plaster.* Open (compound) fractures should have been treated by excision of wounds, sulphanilamide powder and vaseline gauze drainage if circumstances allow, though if air transport can be arranged within, say, three hours of wounding, it may be justifiable to omit this treatment. Details of exact treatment given must be recorded on the plaster and documents.

(v) *Head Injuries*.—Severe head injuries should not be selected for air transport, particularly cases who are deeply unconscious with breathing laboured or stertorous, increasing in rate, or slow, shallow and irregular. Many apparently trivial injuries associated with scalp wounds are in reality more serious than they seem at first, consequently every scalp wound extending down to the bone should be regarded as potentially dangerous, and early evacuation should be considered. These cases are worth transportation by air, because without special investigation, it is difficult to distinguish between a deep scalp wound and a penetrating injury of the brain, and because many such cases, if given expert treatment within the first forty-eight hours, make quick recovery and return to duty.

(vi) *Fractures of the Pelvis and Spine.*—These should be retained long enough for efficient immobilization in plaster jackets, but if it is then clear that the fracture is uncomplicated by injury to viscera or spinal cord, the patients should be regarded as suitable for evacuation by air.

(vii) *Empyema.*—These cases require prolonged treatment and clear up quicker if transferred to a thoracic surgery centre. Though thoracic cases as a whole travel badly by air, patients with empyema can be safely transported if aspirated beforehand.

(viii) *Tuberculosis.*—It may be desirable to transport such cases by air to lessen the risk of infection in the field. Provided there has been no recent hæmoptysis and there is not much anæmia, air transport can be undertaken.

(ix) *Enteric Fever and Dysentery Cases.*—These may require more rapid transportation from the field of active warfare. Such cases should only be transported early in the disease and at low altitude to avoid dangers resulting from gaseous distension of the bowel (gut).

B. CASES UNSUITABLE FOR AIR TRAVEL

- (i) Shock.
- (ii) Abdominal and thoracic wounds.
- (iii) Acute abdominal conditions.
- (iv) Recent severe hæmorrhage, including hæmoptysis and hæmatæmesis.
- (v) Gas gangrene.
- (vi) Chemically gassed.
- (vii) Lobar pneumonia.
- (viii) Pneumothorax.
- (ix) Angina pectoris.
- (x) Coronary occlusion, during first month of condition.
- (xi) Meningitis, during period of increased intra-cranial pressure.

(i) *Shock.*—No patient in a condition of severe shock, or when it is likely to develop within a short time, is suitable for air transportation.

All suitable methods of resuscitation should be employed for such patients coupled with the treatment necessary for the injuries. The time needed for this may be anything up to twenty-four or even thirty-six hours, during which period the patient can be given rest, warmth, morphia, fluids by mouth or rectum, oxygen, intravenous therapy, according to the available facilities.

(ii) *Abdominal and thoracic wounds* are, in general, unsuitable for evacuation by air because they should, if possible, receive adequate surgical treatment before being moved and because they are so liable to suffer from distension of gas in the bowel (gut) and thorax as a result of lowered atmospheric pressure. If weather conditions and terrain permit flying below 4,000 ft., certain of these cases could be transported by air, but great care must be exercised in their

selection. No abdominal case should be transported by air within five days of operation.

(iii) *Acute abdominal conditions*, such as perforated and gastric and duodenal ulcers, acute appendicitis, intestinal obstruction and peritonitis from any cause, are unsuitable for air transport.

(iv) *Recent severe hæmorrhage*, from any cause such as wounds, hæmatemesis, malæna, hæmoptysis, hæmaturia, is an absolute contra-indication to air transport. No patient with a tourniquet already applied and with hæmorrhage otherwise controlled should be sent by air. Appropriate treatment for arrest of hæmorrhage is essential before transport.

(v) *Gas gangrene cases*, suspected or established, should not be transported by air until adequate treatment has been carried out.

(vi) *Chemically Gassed*.—No patient with injuries due to mustard or other liquid gas is to be admitted to an air ambulance or aeroplane until after complete decontamination. Those gassed by pulmonary irritants are obviously unsuitable for air transportation.

(vii) *Pneumothorax, angina pectoris and coronary occlusion*—in fact, *lung and heart disease cases*, are particularly bad subjects for air travel. Cases of coronary occlusion, if making good recovery, can travel by air after the first month of the condition, provided that the ceiling is under 10,000 ft. and an adequate oxygen supply is available.

(viii) *Meningitis* cases should not be sent by air as long as there is definite increase of intra-cranial pressure, as this will be further raised with increase of altitude.

(ix) *Sulphonamide*.—No one while on oral or intravenous treatment with sulphonamide should be transported by air if the altitude is likely to be greater than 5,000 ft. However, as we heard yesterday from Brigadier Fettes, the indications for the use of sulpha drugs have been considerably amended by the Medical Research Council. It will follow, therefore, that cases under sulphonamide medication will not now be included.

I have no intention of dealing with the subject of medical equipment for air ambulances, but all I would say is that it should not be heavy *in toto* and should be on the lines of a comprehensive first-aid equipment.

In conclusion, I trust this short outline of the Clinical Aspects of Air Evacuation of Casualties will be helpful and provide food for thought in planning a scheme for field operations.

I would like to express again my gratitude and appreciation to the Director-General of Medical Services for the opportunity he has been good enough to afford me in saying these few words.

MEDICAL APPRECIATION

WE are happy to be able to reproduce the Medical Appreciation written for the recent Medical Exercise "BAMBOO."

Two of the annexures only (1 and 5) are included. Medical Appreciations are written as a guide to the Commanding Officer of a Force or Formation ; the salient points should be summarized and placed first, should he wish to refer to any point of detail he can do so in the fuller appreciation.

Most of our more Senior Officers will have had practice in writing appreciations in the Field but there are already many of a younger generation to whom they are merely an intellectual exercise, part of their training, to be produced as part of an Exercise or as an essential part of a promotion examination. The one we print was written from the point of view of a D.M.S. advising his Commander-in-Chief who was about to engage in a campaign in a tropical country. Malaya was chosen, but it is the principles that matter—not the actual terrain. The outline and headings as given can be used to appreciate a situation in any climate or terrain.

MEDICAL APPRECIATION

- ANNEXURES :
1. Diseases other than those of Military Importance.
 2. Clothing Scales.
 3. Medical Units Available in Theatre.
 4. Medical Units Required.
 5. Preventive Measures.

OBJECT

1. The maintenance of the health, the medical treatment, care and evacuation of the sick and wounded of the force.

CONDITIONS AFFECTING THE ATTAINMENT OF THE OBJECT

TERRAIN AND CLIMATE

Terrain

2. (a) Evacuation of the sick and wounded in this theatre will present grave difficulties since movement in the jungle is limited to foot and pack transport, and in the coastal areas vehicle movement is extremely difficult in the monsoon ; hence the use of river transport must be considered and air transportation must be exploited to the fullest degree.
- (b) Air evacuation by transport aircraft is limited by the extent of air superiority, the existence of landing grounds and by climatic conditions. These limitations are applicable in a much lesser degree to air evacuation by light aircraft. The effective use of light aircraft and helicopters if available, should be possible to a large extent throughout the theatre, and even during the monsoons.

Climate

3. The climate of the theatre may be classified as humid-tropic. In this atmosphere of high humidity and high temperature sweating is excessive and almost constant. The resulting conditions combined with the absence of any real relief by a substantial drop in temperature at night are conducive to early fatigue and lassitude. On the hill-tops, however, at heights of three to four thousand feet very cold nights must be expected and suitable provisions must be taken against them.

Rainfall

4. The heavy rainfall and wet climate produce an environment ideal for the growth of fungi and moulds which have an exceedingly deleterious effect on stores and equipment. Special tropical packing will be necessary for a great variety of stores. Precision instruments such as microscopes will be quickly rendered useless without special precautions in packing.

DISEASE

5. It is impossible to over-estimate the potential menace of disease in this theatre. The greatest menace of all is malaria and it is safe to say that a force operating in this theatre without adequate preventive measures would cease to be effective within a few months from this cause alone. No means must be neglected to combat this enemy and the fight against malaria must be considered an operational matter rather than a purely medical one. With adequate preventive measures implemented with complete thoroughness the sick rate need be no higher than that for a force operating in Europe. This had been proved by the experience of Fourteenth Army in Burma and of the Australians in New Guinea in the last war.

*Diseases of Major Military Importance*6. (a) *Malaria*

This is by far the greatest *potential* danger to the force.

(b) *Scrub Typhus*

This disease is spread by the agency of ground mites ; the danger of infection is limited to certain localities. The actual incidence of the disease is not likely to be heavy, but it is important on account of the high mortality rate and the consequent effect on morale.

(c) *Bowel Diseases*

Amœbic dysentery.

Bacillary dysentery.

Cholera.

Infection is spread by the agency of impure water and flies. The incidence of these diseases is likely to be high in the early rains owing to the flushing of the dry water channels and consequent heavy infection of the water by the accumulated filth. Danger is ever present when troops are in close contact with the native population owing to the lack of sanitation in native villages. Of these three diseases, bacillary dysentery and cholera are the greatest *potential* dangers, but we have in the drug sulphaguanidine an agent which has reduced the menace of bacillary dysentery to a great extent, and inoculation is an effective agent against cholera. For amœbic dysentery we have no specific preventive agent and there is no specific cure, but the disease itself is less immediate in its effect and less likely to inflict sudden heavy and widespread casualties. Prevention will depend upon good water discipline and the implementation of general hygiene measures.

(d) *Skin Diseases*

The climatic conditions are eminently suitable for the development of incapacitating skin diseases. The incidence is likely to be high and skin conditions will form one of the most serious causes of wastage owing to the difficulty in effecting cure in this humid climate. The establishment of special hospitals in the hill stations must be envisaged. Skin infections, of the foot, fungus infections, ringworm, etc. are likely to be particularly rife and to cause considerable wastage.

(e) *Venereal Disease*

Venereal disease is common among the native population, both in urban and rural areas. Infection rates are likely to be highest at the bases.

(f) *Psychoneurosis*

The incidence of psychoneurosis will depend upon the adequacy of the preliminary screening, the amount of physical and moral strain to which troops are subjected and the adequacy of the welfare arrangements.

(g) *Dengue Fever*

Infection is caused by a species of mosquito. The disease is not dangerous from the point of view of life but an epidemic can have a sudden crippling effect on a force. There is no specific preventive or cure for this disease.

(h) *Infective Hepatitis*

The actual cause of this disease is as yet unknown though it is considered to be due to a virus, spread through the agency of food and flies. The incidence in a force with a good standard of hygiene will be small but will increase with any relaxation of the standard.

DISEASES OTHER THAN THOSE OF MAJOR MILITARY IMPORTANCE

7. Diseases of lesser military importance and diseases likely to be met with in the civil population are listed in Annexure 1.

WATER SUPPLIES

8. Water supplies will normally be adequate but it is stressed that during the dry season tactical movement of troops will be dictated by the availability of water in sufficient quantity in the area concerned. Water points must be strictly controlled and water must be supplied to troops chlorinated or chloraminated. The importance of strict water discipline must be stressed. The provision is recommended of millbank bags and individual sterilizing outfits. The use of these articles should be restricted to circumstances in which bulk purified supplies of water are not available.

FOOD SUPPLIES

9. The importance of the supply of a completely adequate ration to personnel engaged in this theatre cannot be over-stressed. Calory requirements will be approximately 4,000 calories a day, but the mere provision of requisite calory value, protein and vitamin content in a diet is not enough. Food must be produced and supplied in the most palatable form otherwise in such trying conditions as are encountered in jungle warfare it will not be consumed and will merely appear on paper as a diet satisfactory from a scientific viewpoint. It is essential that every effort be made to supply troops in forward areas with fresh meat regularly and frequently. In order to implement this supply, fullest use of refrigeration must be made. The use of refrigeration in ships, road and rail transport and in aircraft must be exploited to the full. Refrigerating plants on an adequate scale must be established at the bases and subsequently farther forward and air transport must be used as a means of quick delivery of fresh food. The provision of an operational ration properly packed for use in the tropics, palatable and of the requisite calory value is required. Every effort should be made to avoid keeping troops for too long on a pack ration. The use of fish as a food supply in coastal areas should be exploited to the full. The whole force should take Multivitamin tablets on the scale of one per man per day.

CLOTHING AND EQUIPMENT

10. (a) It is most important that clothing and equipment should be suitable for the conditions which will be met. All articles of clothing and equipment should, ideally, combine maximum strength with minimum weight—lightweight blankets should be in supply. The provision of mosquito-proof clothing is not recommended unless a material can be produced which permits of adequate ventilation and is not unduly hot. Hitherto mosquito-proof uniform has proved a failure owing to production of excessive sweating. Further research including the possibility of

impregnating clothing with anti-malarial chemicals is now being undertaken. Long trousers should be worn throughout the theatre at all times except when bedded down. Shorts should not be issued nor should the wearing of shorts be permitted.

- (b) Mosquito nets should be issued on a 100 per cent basis. The present net with its fine mesh is undoubtedly most oppressive for use in hot climates and the risk of its being thrown back during the night even by well-disciplined troops is great. Research is now being directed to the production of a wide-meshed impregnated net which will afford full protection.
- (c) A list of clothing scales is shown in Annexure 2 (not reproduced).

ACCOMMODATION

11. Accommodation in buildings will not be available in forward areas and will be extremely limited in the rear areas. Accommodation will be at first mainly tentage with basha accommodation later in the more static areas. The effect of moulds on the life of the tentage must not be overlooked in provisioning. Improvisation of shelters will be largely required in forward areas and attention should be given to this during training.

ESTIMATION OF CASUALTIES

12. The overall strength of the force is estimated at 300,000. Anticipated sick rate is 0.3 per cent per day. Hospital beds are at present provided at 3 per cent for the Malaya Garrison, estimated at 120,000. The overall total of beds required is 10 per cent of the force. On a sixty-day evacuation policy to Australia it is estimated that 6 per cent will be required in the Malaya theatre and the remaining 4 per cent will be required in the main base (Australia).

MEDICAL UNITS AVAILABLE

13. It is assumed for the purposes of "BAMBOO" that the medical units detailed in Annexure 3 would be in the theatre. Medical units other than those with field formations are just sufficient to meet garrison requirements.

MEDICAL REQUIREMENTS

14. The total requirements of medical units (inclusive of those shown in Annexure 3) are shown in Annexure 4. A list of those still required is also given. These latter units will be phased into the order of battle as the operations progress.

15. In addition to the units listed as deficient, certain consultants including a malariologist and advisers will be required.

16. It is important to stress the necessity for formations arriving in the theatre complete with their appropriate allotment of medical units. It is essential that the build up of medical units within the theatre should proceed alongside that of the troops for whom they will provide medical cover.

PLAN FOR MAINTENANCE OF HEALTH

GENERAL

17. (a) The maintenance of the health of the force will be primarily dependent on :

- (i) The training of the force.
- (ii) The discipline of the force.

(b) It cannot be too highly stressed, that such is the menace of disease in this theatre, that the fight against disease must be considered an operational matter. All commanders from the highest to the most junior must be imbued with a vivid realization of the necessity for the various preventive measures against disease and the need for the strictest discipline in implementing them.

MEDICAL INTELLIGENCE

18. It will be necessary to collect all available information regarding the incidence and location of diseases throughout the theatre, and to ensure that this medical intelligence

is kept up to date. This information can be plotted on spot maps to show disease areas for each phase of the operation.

TRAINING

19. (a) *Screening*

It is most important that efficient medical examination of all officers and men is carried out prior to their embarkation and that all unfit personnel are eliminated. Each officer and man should be allocated to his correct PULHEEMS (medical category). Medical examination of all reinforcements must be carried out and arrangements made to check their PULHEEMS at reinforcement camps before they are sent forward.

(b) *Education*

All ranks must be forewarned of the hazards to be encountered and of the measures to be taken to counteract them (so far as security reasons permit). Fear of the jungle may be largely mitigated by propaganda and the value of films, pamphlets, and of discussion groups should not be overlooked.

(c) *Acclimatization*

(i) Attention must be paid to the time factor in the acclimatization of troops. It is unwise to plunge troops soft from a sea voyage straight into jungle training in a climate to which they are unaccustomed. It is considered that at least six weeks' residence in the country is necessary before jungle training is commenced. In the early weeks only light work should be performed, gradually increasing to full training at the end of that period. A further period of full jungle training will then be necessary, the length of which depends on factors not primarily medical.

(ii) Sunbathing should be instituted on the outward voyage and on arrival troops should be trained to work in daylight hours wherever possible stripped to the waist. This will lessen the incidence of skin disease and ensure against sunburn due to sudden inadvertent exposure of the untanned skin. Shirts, however, must be taken into use immediately at dusk.

(iii) During this preliminary and jungle training, an adequate intake of fluid and salt must be assured. False ideas of hardening men by the restriction of water must be condemned. Men under training will need two and a half gallons of water per day to which salt has been added.

(d) *Hygiene Training*

In addition to training in communal hygiene and in the various preventive measures against disease it is important that the soldier should have a high standard of personal hygiene. The necessity for frequent cleansing of the skin by washing, care of the feet, and the use of foot and body dusting powder as a routine, and the need for frequent changes of socks and under-linen must be stressed during training.

DISCIPLINE

20. It is reiterated that on the existence of a high standard of discipline will depend the maintenance of the health of the troops and thereby of the success of the operations. Discipline in hygiene measures and particularly in anti-malarial measures must start at the top and thence permeate the whole force. It is considered that where high incidence rates of malaria appear among units or formations indicating a slackness in anti-malarial discipline, disciplinary action should be visited on the unit or formation commander.

PREVENTIVE MEASURES

21. (a) Preventive measures are the weapons at our disposal in the fight against disease. It is essential firstly that the soldier should know his weapons and know how to use them, secondly that commanders at all levels should so direct these weapons as to ensure the maximum of effect.

- (b) The preventive measures appropriate to the diseases of major military importance are shown in Annexure 5. It is essential to the success of the campaign that these measures should be studied and known by all concerned.

PLAN FOR THE CARE AND EVACUATION OF THE SICK AND WOUNDED OF THE FORCE MEDICAL BASES

22. (a) The main medical base is Australia.
(b) The main advance medical base will be built up in Singapore with a subsidiary advance base at Butterworth.

EVACUATION

23. (a) Evacuation from Malaya initially will be in the main by hospital ship, latterly by transport aircraft and hospital ship. (The turn round time by sea to Australia is approximately seven weeks).
(b) Evacuation within the Theatre.
(i) *Rearward Areas*
On the East by transport aircraft and ambulance trains. On the West by transport aircraft, hospital ship.
(ii) *Forward Areas*
By light aircraft, ambulance cars and stretcher jeeps. In connexion with the light aircraft, helicopters of the Fairey Gyrodyne type would prove invaluable.
(c) The aim must be to attain 100 per cent evacuation of casualties by air at as early a date as possible and for the medical services to have their own air effort to carry this out.
(d) Should the operations envisage assault landings it is essential in the planning of these landings that the medical services be allotted whole-time landing craft for casualty evacuation purposes.
(e) Experience has proved that the modification of all hospital ships to carry the equipment of such medical units as casualty clearing stations and general hospitals is invaluable. The carrying of such units by these ships is covered by the Geneva Convention and this greatly assists the movement staff in their shipping transport problem.

HOSPITALIZATION

24. (a) Hospital beds will be required in Australia at 4 per cent of the total force. A build up of 6 per cent fixed beds will be required in the Malaya theatre of operations at the same rate as the arrival of troops from overseas. Of the 6 per cent fixed beds required 5 per cent will be split between the main medical advance base at Singapore and the subsidiary medical advance base at Butterworth, the remaining 1 per cent being required as a follow-up of the Army.
(b) It is essential that the build-up of hospital beds in Malaya to 6 per cent of the troops to be engaged in operation is effected before operations commence and that the subsequent build-up of hospitals takes place prior to or at the same time as the arrival of additional troops from outside theatres.

MEDICAL STORES

25. The main medical store depot will be built up in Singapore with a subsidiary depot at Butterworth. Stocks to be built up as rapidly as possible to six months' reserve plus normal maintenance holdings.

ANNEXURE 1

DISEASES OTHER THAN THOSE OF MAJOR MILITARY IMPORTANCE

SERIOUS DISEASES LIKELY TO AFFECT SMALL NUMBERS OF TROOPS

- | | |
|-------------------|---|
| 1. Smallpox | } In a Force with 100 per cent vaccination and TAB inoculation these potentially grave dangers may be considered as of minor military importance. |
| 2. Typhoid Groups | |

3. Cerebrospinal Meningitis } Sporadic cases may occur. Even in epidemic form the
4. Infantile Paralysis } numbers affected are likely to be small.
5. Pneumonia. Common in Siam. African troops may be affected if employed in the hills during the wet season.
6. Tetanus. Prevalent throughout the area. With toxoid inoculation throughout the force and anti-tetanic serum injection of the wounded, few cases will occur.
7. Gas Gangrene. Not strictly a disease but a dangerous complication of wounds. Likely to be met with in fighting in cultivated areas.
8. Rabies. Common in dogs throughout the theatre. Occasional cases will occur. Supplies of anti-rabic serum will be required.
9. Filariasis (Elephantiasis). Common among native population. Unlikely to affect white troops but cases among Africans may occur.
10. Leishmaniasis (Tropical sore and Kala-Azar). The vector of the disease, the sandfly, is common and sporadic cases will occur.
11. Schistosomiasis (causing enlargement of liver and spleen). Common in the Bangkok area. Conveyed through the agency of snails in fresh water channels. Special orders regarding bathing may become necessary.
12. Blackwater Fever (a form of malaria). Will *not* occur if suppressive drugs are taken.
13. Nutritional Diseases.
 - (a) Beriberi } Will not occur so long as a well-balanced diet is available and Multi-
 - (b) Pellagra } vitamin tablets are taken daily.
 - (c) Scurvy }
14. Snake bite. Supplies of anti-venom serum will be necessary.

LESS SERIOUS DISEASES WHICH MAY AFFECT LARGE NUMBERS OF TROOPS

15. Intestinal Parasites. Hookworm is prevalent throughout the area and it is possible that formations may find themselves affected. If on investigation this is found to be the case, wholesale worming of units during rest periods must be undertaken. The disease is contracted by walking about barefoot, thus African and Gurkha troops are likely to be the chief victims. Prevention lies in the implementation of orders concerning the constant wearing of boots.
16. Heat stroke.
17. Sunburn.

DISEASES AFFECTING THE NATIVE POPULATION BUT UNLIKELY TO BE CONVEYED FROM THEM TO THE FORCE

18. Tuberculosis.
19. Diphtheria.
20. Measles.
21. Rat-bite fever.
22. Relapsing fever.
23. Infection with flukes.
24. Leprosy.

ANNEXURES 2, 3 and 4 are omitted.

ANNEXURE 5 PREVENTIVE MEASURES

MALARIA

Administrative Measures

1. (a) The institution of a malaria control committee at Army, Corps and Divisional headquarters, to co-ordinate and control anti-malarial work and to ensure that medical recommendations are put into effect promptly.

- (b) The appointment of malaria control staff officers for a similar purpose.
- (c) Close co-operation with the civil government and health authorities to ensure that existing health services are maintained and existing anti-malarial engineering schemes are kept in operation.
- (d) The preparation of spot maps in respect of the disease for each phase of the operations envisaged.

Collective Measures

- 2. (a) Engineer attack on breeding places by drainage, fillings, etc.
- (b) Attack on the mosquito at all stages of its life cycle, by oiling and chemical attack (DDT) on breeding places, by the use of residual DDT, DDT barrier spray, and by the use of DDT spray from the air.
- (c) The institution of mosquito surveys and estimation of splenic indices among the native population.
- (d) Siting of camps with a view to avoidance of breeding areas and non-proximity to native villages (whose inhabitants are the reservoir of infection).

Individual Measures

- 3. (a) Use of nets throughout the theatre except when in actual contact with the enemy.
- (b) Use of impregnated fish-netting for heads and hands by troops in contact with the enemy.
- (c) Use of repellents. Individual supply of DMP (Dimethylphthalate) in containers to all troops will be necessary.
- (d) Use of suppressive drugs—Paludrine—one tablet (0.1 gramme) to be taken by all troops daily. (Paludrine is a new drug which is claimed to be superior to Atebrin in that it is free from certain disadvantages which pertain to Atebrin).
- (e) Wearing of long trousers at all times except when bedded down.
- (f) Wearing of long sleeves from dusk to dawn.

Note on the Action of Suppressive Drugs

- 4. (a) Two types of malaria will be encountered, malignant tertian (MT) and benign tertian (BT).
- (b) Of the two, malignant tertian malaria is by far the most dangerous and in many areas the most common. It is a deadly and killing disease. Benign tertian malaria is less severe in its effects but more difficult to cure.
- (c) The term suppression means that all evil effects of the disease are rendered nugatory and hence no symptoms will appear during the period in which suppressive drugs are taken. On the cessation of suppressive drugs, the malaria parasites, latent and completely harmless during the period of suppression, increase in numbers and cause symptoms. This is known as the "break through" of malaria.
- (d) Suppressive drugs in the requisite dosage (Atebrin 0.1 gramme daily, Paludrine 0.1 gramme daily) not only suppress malignant tertian malaria but *completely cure it*. With benign tertian malaria, however, the effect is one of suppression only and the "break through" may occur when the suppressive drug has ceased to be taken and its effects have worn off.
- (e) The use of suppressive drugs may be regarded as the greatest single weapon in the armoury of anti-malarial prevention. Hence the paramount importance of ensuring its fullest effectiveness.

SCRUB TYPHUS

- 5. Avoidance of areas known to be contaminated.
- 6. Avoidance of sitting or lying on the bare ground except when really necessary.
- 7. Constant wearing of trousers, puttees and boots.
- 8. Application of an insecticide DBP (dibutylphthalate) to the clothing. This must be carried out as drill at regular intervals.

BOWEL DISEASES*Collective Measures*

9. (a) Strict water discipline.
- (b) Elimination of carriers of disease from the food handling staff.
- (c) Unremitting war against flies by all means and especially by the application of DDT residual spray.
- (d) Strict hygiene measures with regard to the disposal of waste and excreta.
- (e) Insistence upon the early reporting sick of all troops suffering from diarrhoea and their early treatment (at regimental aid-post level) with sulphaguanidine to ensure sterilization of the excreta.

Individual Protection

10. (a) 100 per cent inoculation of the force with TAB vaccine.
- (b) Avoidance of uncooked vegetables and fruit.
- (c) Use of cholera vaccine when occasion arises.

VENEREAL DISEASE

11. Preventive measures must be viewed from all angles and it must be recognized that the prevention of venereal disease is more a matter of discipline and morale than a medical responsibility.
12. The co-operation of the adjutant-general's branch, provost, medical and the chaplains is necessary at all levels and the establishment of a committee to advise the commander on this important question is recommended.
13. Instructions on the dangers of venereal disease must be given to the soldier by films, talks and pamphlets.
14. Preventive ablution centres (PAC) must be installed wherever required. ET packets and sheaths must be available on a liberal basis.

SKIN DISEASES

15. Provision of adequate washing and bathing facilities.
16. Provision of adequate supplies of underwear and socks.
17. Provision of adequate laundry facilities.
18. Provision of foot and body powder.

PSYCHONEUROSES

19. Preventive measures will include :
 - (a) Adequate preliminary screening of the force.
 - (b) Provision of amenities and welfare facilities as far forward as possible. Opportunity to be given to all troops to enjoy the amenities offered at frequent intervals, particularly during the monsoon. Facilities at such centres to include, as an essential, dry living quarters, hot baths and drying bags for clothes, together with a carefully arranged and varying diet.
 - (c) Provision of recent newspapers and journals. A force newspaper should be instituted and the aim should be to distribute it to forward troops on the day of issue.
 - (d) Provision of a regular and speedy postal service. Few things have a more deleterious effect upon morale than the lack of good communication with those at home.

DENGUE

20. Mosquito control is the most effective prevention of this disease.

INFECTIVE HEPATITIS

21. Attention to the strictest cleanliness in the preparation and serving of food.
22. Rigorous anti-fly measures.
23. Efficient disposal of excreta.

A CONFERENCE ON THE ANNUAL REPORT

Anonymous

FROM time to time opinions have been voiced that a conference of Officers Commanding Military Hospitals for the interchange of ideas on organization and administration would prove very useful. If most of the preliminary spadework were undertaken by the personnel of the units concerned, such a conference would also be of great moral and instructional value. As a first step it is suggested that an exercise on the Annual Report might be held. To many specialists the preparation of an Annual Report appears to be a waste of time and effort, and the first fortnight of the year is burdened with protestations against an apparently unresponsive and unproductive bureaucratic system. Such a mental attitude is liable to influence the Report adversely and so a disservice is done to the "Corps," the specialty and to the officers themselves.

It is not generally realized that the Regulations for the Medical Services of the Army, 1938, lay down that the reports of specialists will be forwarded to the War Office by the D.D.M.S. of the Command, along with his consolidated report. By the enlightened officer the preparation of an Annual Report is considered to be a privilege, as it is a channel of approach to the Advisers of the Director-General, and ultimately to the Director-General himself.

The incentive to produce a good report should be firstly one's pride, the feeling of pleasure on account of something worthily done, and secondly, the knowledge that a good report is invaluable to the Medical Directorate if the views expressed help those responsible to appreciate the trends of advancing medicine in relationship to the Army.

The Report should include a summary of the whole year's professional work ; a record of difficulties encountered and overcome.

Statistics are important and graphs too, if they show the tendencies of diseases and point out the way to advances in Army Health. They may stress the necessity for research work which might be carried out under the auspices of the "Corps," or a body such as the Medical Research Council. The précis of an interesting case is valuable as it may be required for reference in five, ten or fifteen years' time. In the notes on medical equipment one can aid the administration by drawing attention to recent improvements or by giving reasons why certain instruments are becoming obsolete. Views on accommodation are also essential ; waiting rooms considered adequate some twenty years ago may not answer present day requirements. In making suggestions it should be noted that, although one gives the ideal, it is important to offer alternatives which can be pressed into service at an earlier date.

The acid test of a good report is whether or not it can be used as a criterion of efficiency. Would it be good enough to support an application for an award of merit under the National Health Scheme ? Some officers may inwardly feel

that on their last Annual Report it would have been very difficult to have earned a mere ten marks for neatness.

It is unfair to blame the present day specialist for submitting a mediocre report if its object has not been fully explained to him. Nowadays, both in civil and service life, one deals with a plethora of forms and reports and to the uninformed one report more or less does not matter.

Occasionally, it falls to one's lot to take over an appointment towards the close of a year, only to find that one's predecessor, in the excitement of release from the Army, or for some reason best known to himself, has omitted to account for his year of office. Here is an environment which may engender bitter feelings. However, to assume the role of historian may have many compensations.

Perhaps the tyro has been soured by an atmosphere in which his ideas and suggestions have been neglected or dealt with in an unkindly manner. Specialists' reports are in some cases gathered in without even an acknowledgment. Consequently, despite the satisfaction of having completed a good report there develops a feeling akin to that of having put a penny into a slot machine only to pull out an empty drawer.

It is for these reasons that one suggests that an exercise on the Annual Report should help to raise the morale of staffs and be of benefit in collecting ideas for future development.

EXERCISE ANNUAL REPORT

To effect the smooth running of their establishments and capture the interest of staffs, modern industrialists place great reliance upon working parties. These working parties are the medium through which all interested may have an opportunity to offer their suggestions for the general improvement of the organization. Personnel management must now be considered an integral part of hospital administration. In America, hospital authorities have learnt much from adopting the methods used in industrial circles.

Lord Montgomery stressed another aspect of management when he advocated that where possible all concerned should be taken into confidence, so making them partners in the task.

Cederstrom, the architect of the Sodersjukhuset Hospital, Stockholm, before incorporating the design of a ward in his hospital plan, built a working prototype of the room and then co-opted the hospital personnel using it to study it and its equipment. He charted the traffic routes of the personnel in relation to the equipment and having arranged it to the best advantage, called a meeting of all personnel using the room for a final discussion before adopting the design.

All such methods can be used with advantage to help in the elucidation of problems arising in military hospital organization.

Among the points for consideration put forward in various specialists' reports were the following :

1. Canteen facilities for out-patients.
2. Ward examination and consultation rooms.
3. Wall pictures or murals for decoration of wards.

4. Staff cloak-rooms.
5. The supply of green linen for operating theatres.
6. Central supply service.
7. The reception of patients and visitors.

PHASE 1

With the intention of allowing all concerned to read and consider the Annual Report of the Hospital copies of it together with its Appendices are circulated to all who have submitted divisional or specialist reports, to the Principal Matron and the Sister i/c of the operating theatre, to the Welfare Workers and to the Registrar and the Quartermaster, and finally to any officer who may with advantage be co-opted, e.g. the Garrison Engineer and Chaplain.

Those receiving copies are asked to digest the contents and be prepared to give constructive advice on any of the recommendations which may affect their departments. It is essential that each knows the feelings and views of his own staff. For example, if the matter under consideration is the fitting of a wash hand basin into the ward the views of the staff using the ward and those of the patients as well as those of the engineers, must be carefully considered. The ideal site for the plumber probably upsets the spacing for the beds. Again, the placing of a basin adjacent to the entrance to the ward may be of advantage to the Medical Officer whose chief concern is to wash his hands before leaving the ward, but of serious disadvantage to the nursing orderly who has to scrub up between dressing different cases and naturally prefers a central position. From the patient's point of view the proximity of a basin near the head of a bed may be very disturbing.

PHASE 2

From the list of those directly concerned and co-opted the chairman and members of working parties are selected in such a way that all aspects of the question may be fully discussed. The following are examples of selections :

- (i) *Subject* : Canteen Facilities for Out-patients. Suggested by the Specialist in Medicine.

Chairman	The Matron.
Members	Specialist in Medicine.
	Specialist in Dental Surgery.
	Welfare Worker (B.R.C.S. & St. J.).
	Quartermaster.

- (ii) *Subject* : Staff Cloakrooms.

Suggested by Specialist in Ophthalmology.

Chairman	O. i/c Medical Division.
Members	Specialist in Ophthalmology.
	General Duty Medical Officer.
	Sister i/c Surgical Ward.
	Garrison Engineer.

(iii) *Subject* : Reception of patients and visitors.

Suggested by the Chaplain.

Chairman	O. i/c Surgical Division.
Members	{ Specialist in Dermatology.
	{ Specialist in Radiology.
	{ Welfare Worker (B.R.C.S. & St. J.).
	{ Chaplain.

PHASE 3

EXTRACTS OF VERBATIM REPORT OF NO. 1 WORKING PARTY

Chairman : The Matron

TERMS OF REFERENCE : To report upon the necessity of a canteen service for out-patients and whether or not the provision is feasible.

Medical Specialist : I originally suggested that canteen facilities should be provided for out-patients because most of my patients have to travel long distances to attend the out-patient clinic. Although we have an appointment system, trains and buses rarely fit in and whatever we do the soldier has a considerable wait. By mid-morning he has missed his usual tea break and like myself is hypo-glycaemic. I am able to go to the Sister's duty room and *rationalize* a cup of tea and a biscuit. The patient is not so fortunate. Consequently, one sees him at a disadvantage, he is hungry and anxious to get away. In all the hospitals in the C.M.F. in which I worked canteens for out-patients were run by a Welfare Association. They were much appreciated and did very good work. Civil hospitals in this country all have their out-patient canteens. I feel that they are a necessity in the Army.

Quartermaster : There is, of course, the N.A.A.F.I. The soldier, as you know, should bring with him his haversack ration.

Chairman : Theoretically the soldier should have his haversack ration but in practice he usually does not. Now, my nephew is a trooper in the Blanks. Last Thursday, as the result of toothache, he was hurried into an ambulance waiting at the M.I. Room door and taken to the Dental Centre along with those for admission to hospital. He had no time to collect a ration and it is doubtful if he could have obtained one even given time as application for sandwiches has to be made the night before. We must also remember that today the O.P.s include men, women and children and the occasional Pensioner.

Welfare Worker : In America canteens for out-patients are considered a necessity. Their canteen staff are girls who have been trained as social workers. The N.A.A.F.I. is a quasi military organization and to my mind is out of place in an out-patient department where welfare work is frequently called for.

Dental Specialist : My brother has just returned from Canada where they are very keen on cafeterias for the O.P. Departments. Their set up is like that

of a milk bar, you sit on high stools round the counter. In addition they have part of the floor occupied by small tables. The staff are very energetic and keep the place clean, bright and tidy. I would value a canteen service here. It is no joke taking out a soldier's tooth and then sending him home by a bus without giving some refreshment. If a patient is a little pale after the anæsthetic I send him along to my ward and ask the Sister as a favour to make a cup of tea for him.

Medical Specialist : The cafeteria system is not suitable for this type of hospital. What we require is a service tea-trolley capable of supplying say 50 cups of tea without replenishment. Slab cake or a small packet of biscuits are the only eatables required, but it is essential that the tea be served in a decent fashion, i.e. in good china cups with saucers and teaspoons.

Quartermaster : If you put the soldier in decent surroundings and give him good utensils he will appreciate them. It is only when the show becomes mediocre and shabby that his reaction is to break the place up and steal the cups and spoons. The trick cyclists say that this is a natural reaction to third-rate surroundings. In my opinion, if you have a well dressed and nicely spoken lady in charge of the canteen it will prove a success.

Medical Specialist : I am so glad that none of us entertains the " pull in " type of cafe used by the road transport. The serve it up and serve it at 'em system is just too terrible. I would like to see my patients being served with tea as one would expect to be in the lounge of the Ritz Hotel. This would raise the whole tone of the clinic. Somebody started the ball rolling in '43 when they advocated making the M.I. Room into a Harley Street Clinic. Why has this been forgotten ? We managed to do things like this during the war.

Welfare Worker : If we are determined to run a first-class show there should be no difficulty in getting a Voluntary Aid Association to take over the work.

Chairman : Remember, we are not setting up a canteen. Our instructions are to investigate the possibilities and to draw up a report so that the powers that be may have a clear picture of our local conditions to help them in their decision.

Quartermaster : You will all realize that there is no chance of getting accommodation such as a room with a gas stove. However, if the project comes off we will be able to supply the hot water from the kitchen.

Chairman : I think we have examined most aspects. I would suggest that our report might be on these lines :

The majority of people are accustomed to take some refreshment in the mid fore- or afternoon. In attending the out-patient departments at this hospital this refreshment is frequently missed. The effect on a patient who on account of ill-health is already below par is real and consequently he is seen at a disadvantage. Civil hospitals have found the necessity of supplying their out-patients with refreshments which consist of a cup of tea and a piece of cake, or biscuits.

In America refreshment for out-patients is considered in a big way. Most hospitals have cafeterias adjoining the out-patient departments. The assistants have special training and are social workers.

It is felt that there is a very strong case for a small mobile type of canteen capable

of supplying 50 cups of tea at one session. As there is always a welfare potential the canteen might be best run by a Voluntary Aid Society. It is most important that a very high standard be maintained otherwise the canteen service will defeat its object.

Members : Hear, Hear !

EXTRACTS OF VERBATIM REPORT OF NO. 2 WORKING PARTY

Chairman : O. i/c Medical Division

TERMS OF REFERENCE : To consider the adequacy of the present cloakroom facilities for the staff and suggestions for their improvement.

Ophthalmologist : In my last annual report I suggested that a cloakroom be provided for the Ophthalmologists. Today I would extend this to include all the medical staff. With due respect I point out that in this matter the Army is out of date. At the moment I must use the dark room as a cloak room and for the toilet I have to go to another part of the building. Would it not be an economy in time and add to efficiency if a Medical Officers' Cloakroom were provided adjacent to the entrance hall ?

Medical Officer : I entirely agree, the present cloakroom accommodation dates to the days when Medical Officers worked only in the mornings. On arrival at the ward duty room instead of getting immediately down to business, one spends five to ten minutes finding a suitable place for one's hat and overcoat, and moving things on the top of a cupboard to make a space for an attaché case which among other things may contain family rations or sandwiches for lunch. It would be more pleasant to place one's clothing in a private locker, put on a clean starched white coat, and then proceed to the place of duty ready to start work.

Chairman : Now, now, we are dealing with cloakrooms, not white coats.

Sister : I am glad that it is appreciated that mackintoshes, hats, canes and cases unduly litter up a duty room, but why is the discussion confined to the needs of Medical Officers ? Cannot I have a proper place to put my umbrella, raincoat, gumboots and handbag ? Have you not thought of the Nursing orderlies ? What happens to their clothing ? The cloakroom facilities provided for ward orderlies to my mind are inadequate. You must realize that a number of them live out, some cycle six or more miles to work. Their cloakroom accommodation is usually shared as a store room for the ward cleaning gear—this is bad psychologically. The Factory Act today insists that there will be adequate accommodation in which the worker can keep his outer clothing. Most firms provide their staff with metal lock-up cupboards. I would like to see an orderlies' cloakroom similar to the locker room at a Golf Club furnished with mirrors, hair and nail brushes and towels, so that they can come on duty in a clean and smart fashion, whether in dungarees for the rough cleaning of the kitchen, ward or annexes, etc., or in an overall for nursing duties.

Chairman : Sister, are you not using the question of the provision of a cloakroom as a lever to obtain a better turn out for your orderlies ?

Sister : I am not interested in physics, but very interested in raising the standard of nursing by attention to the welfare of the personnel. In the next few months we will see the orderlies provided with white clothes for nursing duties.

Chorus : Come, come, Sister !

Sister : Do you ever see the " news reels " or the " March of Time." All male hospital attendants in Scandinavia, America, etc., are invariably seen wearing white caps, trousers and jackets. The Ministry of Health in this country provides white clothing for male orderlies. Soon this matter must be taken up by the Defence Services, and so it behoves us to get on with our orderlies' cloakroom accommodation.

Garrison Engineer : It is true that adequate accommodation has to be provided for industrial workers. As you know, most lavish changing accommodation at the pit-heads has been provided by the Mining Industry, and other business concerns are following suit. Logically, it is ideal, there is no doubt that all new constructions should have specially designed changing or cloak-rooms for all types of the staff. In the old buildings it is difficult to furnish full accommodation. I can picture the Sister's proposed routine. The nursing orderlies arrive at their cloakroom — they change into their white " ducks," tidy themselves up and then report to the ward for duty. On being dismissed from ward duties they return to their changing room, and if they feel like it can take a shower before donning their outdoor uniform.

Chairman : We can, then, sum up as follows : The working party consider that, according to present day standards, the existing cloakroom accommodation for the staff is inadequate.

In the case of Medical Officers it would be an advantage to have a centrally placed cloakroom in which each member has his own private locker. Toilet accommodation should also be provided here and I would suggest that the provision of notice, bulletin and letter boards would be a distinct advantage.

For Nursing Officers, more especially if they live away from the hospital, similar accommodation together with a rest room should be provided.

For the orderlies it is considered that in addition to locker and toilet accommodation there should be facilities for shower baths and shoe cleaning. Naturally, separate accommodation would have to be made for male and female orderlies.

The working party feel that the question of the provision of hospital clothing for the nursing staff is intimately bound up with this question of cloakroom accommodation, and could with advantage be followed up.

PHASE 4

EXTRACTS OF VERBATIM REPORT OF NO. 3 WORKING PARTY

Chairman : O. i/c Surgical Division

TERMS OF REFERENCE : To report upon the reception of patients and visitors and suggest methods for improvement.

Chaplain : While visiting patients in hospital one learns that a careless reception

of them and their visitors has far reaching effects. Experience has taught us that first impressions are most important. There is no doubt that if one's reception has been polite and kindly any subsequent irregularity is not only regularly excused but frequently defended. A careless or crude reception usually initiates a sojourn of fault finding. My feeling is that a good reception raises the general tone and facilitates the smooth running of a hospital.

Dermatologist : I entirely agree. At my civil hospital there is a smart porter proudly displaying a couple of rows of medals who is at your assistance as you enter the building. You are conducted to a smartly dressed receptionist who gives the impression that you are the most important person in the hospital. There is no doubt that the patient and his friends are impressed and gain confidence by the dignity and quiet cheerfulness with which they are received. Even the staff themselves are impressed.

Welfare Worker : Why are things so different in the Service ? How many times do we see the person in charge of reception sitting at his table with a cigarette dangling from his lips and answering enquiries in a "couldn't care less" manner.

Dermatologist : The Army does seem to accept a lower standard.

Radiologist : You imply that the Army is not as polite or as cultured as the staff of your civil hospital.

Dermatologist : Yes, I do—they are not trained up to the job.

Radiologist : Nonsense ! You know as well as I do that the best hospital porters are the beribboned ex-service men. The fault lies in ourselves. A few weeks ago the C.I.G.S. wrote : "There are no good and bad units, only good and bad officers." This is the key to the problem. In my experience, a hospital reception is best run on parade ground lines.

Chaplain : I feel that as in the Dermatologist's civil hospital a combination of these methods is best. If I were a patient I would like to be met by someone whose bearing and cheerfulness would give me a feeling of stability. He would take me to the receptionist whose kindly manner would increase my confidence. After obtaining the necessary information I would be shown to my ward by a convalescent patient whose evident satisfaction in his treatment would allay any apprehensions that I might still have.

Chairman : You have the right psychological outlook. I am sure that we all agree, but is this practicable today ?

Chaplain : Yes it is. If you had a V.I.P. as a patient the red carpet would be laid down and there is no doubt we would all be happy to do it. You feel in the same way towards Thomas Atkins ; then why not show it, give him the same reception. It costs nothing, but the tone of the organization would be raised considerably.

Welfare Worker : The tendency today is to saddle a selected few with the responsibility of reception. This is not the solution of the problem. All the staff, and for that matter the patients, too, must be inculcated with the spirit of courtesy. One must develop a sense of tradition. "This is my hospital, it is my privilege to render the best service I can." It is only on

such a sound foundation that one can develop a one hundred per cent reception. Then the reception desk becomes the preview of the hospital.

Chairman : It is clear that reception is bound up with Welfare and mutual service. Padre, would you care to sum up ?

Chaplain : It is a fair comment that the reception of patients and their visitors is frequently not all that could be desired. It is suggested that a satisfactory method would be to have a well-groomed and polite soldier as a porter doorman who would receive and conduct all enquirers to an information table. Here the enquirer is received by a trained welfare worker who, after satisfying his questions, hands him over to a convalescent patient to be guided to his destination. It is important to realize that reception does not stop in the entrance hall of the hospital but must be taken up by each member of the staff in turn. This necessitates the building up of a unit tradition of courtesy and efficiency.

C.O. (soliloquizing) : Well, that's over—the cart before the horse as usual. They should have this sort of thing before the Annual Report, not after it.

Leprechaun : There is nothing to stop you, brother.

C.O. : I suppose not. People have taken a keener interest than one would have expected and one or two good ideas have come up. There has been quite a lot of straight speaking—the sisters have by no means minced matters.

Out-patient canteens—well, why shouldn't the soldier and his family have the same facilities as the civilians. Will the N.A.A.F.I. help, I wonder if anyone has ever asked them ?

Cloakroom accommodation—we appear to be a lot behind civilian establishments—the G.E. is all on our side—must get him to draw up a plan. I like the idea of furnishing the place with boards for orders, bulletins and notices. Much better than going to the Registrar's Office.

White clothing for orderlies—reminds me of India—the “Corps” and the regimental nursing orderlies. They did look smart and clean in their white “ducks”—should brighten the place up besides being more hygienic. One must definitely put this up, especially as civil hospitals are going ahead with it.

Reception makes or mars a hospital—I agree that you must get one hundred per cent of the staff interested. The C.I.G.S. was right—there are no good or bad units, only good and bad officers.

Obituary

Lieutenant-Colonel DONALD C. McC. ETTLES, M.B., F.R.C.S.

Royal Army Medical Corps

LIEUTENANT-COLONEL ETTLES was born on November 18, 1902, and died in the Queen Alexandra Military Hospital, Millbank, on May 21, 1949. He qualified M.R.C.S.Eng., L.R.C.P.London, 1926 ; M.B., B.S.London, 1927 ; F.R.C.S.England, 1936.

He joined the Royal Army Medical Corps as Lieutenant on October 25, 1928, was promoted Captain April 25, 1931 ; Major October 25, 1937 ; T/Lieut.-

Colonel in 1943 and substantive Lieut.-Colonel on November 28, 1945 ; T/Colonel in February 1945 to August 1946.

He served in Shanghai, Peking and Tientsin during his first foreign tour. He was an Adjutant, Territorial Army, from 1934 to 1937. During his subsequent tour in India he was appointed Surgeon to His Excellency the Commander-in-Chief ; was O. i/c Surgical Division No. 1 I.B.G.H. and commanded No. 128 I.B.G.H.

He was appointed Reader in Military Surgery, Royal Army Medical College, on August 20, 1948.

He was awarded the Parkes Memorial Prize in 1929, the 1st Montefiore Prize in 1929 and the Leishman Prize of the 36th Senior Course in 1938.

The Consulting Surgeon to the British Army writes :

In spite of wars, the Corps, mercifully seldom of recent years, has been called on to suffer the loss of one of its ablest professional men, cut off with tragic suddenness at the height of his career. Our obituary columns, in the nature of things, have very often to tell the passing of the aged, to note that they have reached the terminal milestone on a long journey of service. There is the sense of regret at parting from an old friend and mentor, or trusted commander, but a sense of sorrowless thankfulness for his long and faithful service. It is shatteringly different when a young man mounting high on the ladder of achievement is struck down. Lieutenant-Colonel Donald C. McC. Ettles, Fellow of the Royal College of Surgeons, Reader in Surgery at the Royal Army Medical College died at Millbank on May 21, 1949, in the 47th year of his life and the 22nd year of his service, beyond aid in the hospital in which he had so often brought healing and life to others. His had been a life of surgical endeavour in our largest hospitals in many countries, culminating in the appointment which is the goal of those who aspire to the heights. Of his success in that sphere, all who have passed through the College and the hospital, know full well—his devoted work as a teacher of anatomy and surgery to those striving for higher degrees, as a writer, and as a most able operative surgeon. Of his successful liaison work with medical schools throughout the country, the tributes paid by civilian consultants are proof, for he was held in great regard and esteem by all, and especially at Guy's, his own old school.

In all these ways he gained high prestige for the Corps and the affection of his seniors and juniors. His loss at this moment when we can ill afford any surgical loss, is as grievous a blow as could have been dealt us.

Our deepest sympathies are tendered to his widow and son.

Colonel E. J. S. Bonnett writes :

I worked with Donald Ettles in Tientsin, North China, in 1933 to 1936.

In this cosmopolitan, prosperous, and then happy part of the world with its five regular and friendly garrisons—American, British, French, Italian and Japanese—we British had a small Military Hospital for our garrison in Peking, Tientsin and Shan-hai-Kuan. Ettles was a lively member of a lively community. A keen, strong swimmer he played water polo amongst good players, was a determined opponent in the squash courts, and joined in almost everything. As a singer with a good tenor voice, he was an active member of the Amateur Dramatic Society and took leading parts in Gilbert and Sullivan productions.

Ettles started his career as an Army surgeon in Tientsin where he was in charge of surgical wards, and kept abreast of his subject by taking every opportunity of seeing cases and assisting in the Civil Hospitals including the magnificent and lavishly equipped Rockefeller Foundation Hospital—The Peking Union Medical College Hospital.

Donald Ettles was a vigorous, restless, individual—a hard taskmaster to himself, critical, expected a high standard, and always did his level best to give such a standard whether to his patients, colleagues, or opponents in sport. He leaves a widow and young son.

Notices

KING EDWARD VII HOSPITAL FOR OFFICERS

HER MAJESTY QUEEN MARY opened King Edward VII Hospital for Officers at Beaumont House, Beaumont Street, London, W.1, on Oct. 15, 1948. The hospital has two wards of five beds and two of two beds, where nursing and maintenance will be free. There are also 17 single rooms, for which the charge will be much less than it would be elsewhere in London. Patients make their own arrangements with their physicians and surgeons. Regular and retired officers of the Royal Navy, the Army and the R.A.F. are eligible for admission ; also all temporary officers of all three Services who fought in the 1914-18 or 1939-45 wars, provided they become subscribers. The annual subscription is £1. Application should be made to the house governor, Beaumont House, Beaumont Street, W.1. Sister Agnes founded this hospital in 1899 at 17, Grosvenor Crescent. Between then and 1941 over 10,000 officers were patients. The premises were badly damaged by bombs in January 1941, and the hospital had to be closed. It is now being reopened as a hospital on the most modern lines.

OFFICERS' ASSOCIATION NURSING HOME, EDINBURGH

THIS is a similar hospital in Edinburgh maintained on a high standard by the Officers' Association.

Membership of the Officers' Association is open to all serving and retired officers living in Scotland. For a life membership fee of £5 5s. members can make use of the facilities of the Nursing Home free of all charge beyond medical fees.

Full information can be obtained from the General Secretary, J. R. N. Graham.

These two Nursing Homes are brought to the notice of R.A.M.C. Officers so that they may either subscribe themselves or let officers with whom they are serving know of the facilities available.

NOTICES OF CORPS FUNCTIONS

EVERY endeavour is made to circulate Regular and Retired Officers of the Corps with details of Corps functions. This is almost impossible, however, unless retired officers keep the Headquarter Mess informed of their latest address. Notices of functions such as the Annual "At Home" and Dinner are published in the Corps Journal, the Corps Magazine and the daily press, but individual notices can only be sent to those Officers who have kept in touch with the Mess. Changes of address should therefore be notified to the Mess Secretary, Headquarter Officers Mess, R.A.M.C., Millbank, S.W.1.

Reviews

ARTIFICIAL PNEUMOTHORAX IN PULMONARY TUBERCULOSIS. By T. G. Heaton, M.B.Toronto. 1947. Pp. 292. Toronto: The Macmillan Company of Canada Limited. \$ 4.00.

This work, designed for those who already have some experience of the subject, represents the fruits of over twenty years' experience in pneumothorax treatment. All aspects of the subject, including intrathoracic dynamics in health and in the presence of pneumothorax, are discussed. On debatable points abstracts of important contributions to the subject are given as a preface to the author's critical comments, and this feature of the work makes it a collection of information which it would be difficult to find so compact and readily accessible. In all these abstracts bearing on various aspects of the subject matter total over three hundred. The chapters on technique, complications and management are clear and concise and readily supply all requirements of reference. Apart from a chapter on extrapleural pneumothorax the surgical aspects of treatment when pneumothorax is impracticable or unlikely to be effective are not discussed. At the end a short chapter on pneumoperitoneum is included. In this the author states that he feels that the method is never likely to be widely used, as after phrenic crush, which should first be tried, "the additional rise of the diaphragm that may be obtained by raising the foot of the bed would seem likely to do all that could be expected of pneumoperitoneum."

The compactness of the wealth of information on pneumothorax in this work will be readily appreciated. The arrangement of the subject matter within the individual chapters adds to the clarity which distinguishes the text.

J. B.

A SHORT PRACTICE OF SURGERY. Eighth Edition in 5 parts. By Bailey and Love. Published by H. K. Lewis & Co., Ltd. Pp. x + 232, 259 illustrations, of which 89 are coloured. Price £2 12s. 6d. the set (not sold separately).

Parts 1-4 have already been reviewed. With the appearance of Part 5 the issue is complete. It deals with the injuries and diseases of bones, joints, muscles, tendons and bursæ, and there is a chapter on deformities.

The new part is of the same high standard and the complete edition presents the subject in the most assimilable fashion to anyone requiring a rapid "brush up" on the practice of surgery.

D. F.

EDITORIAL NOTICES

The Editor will be glad to receive original communications upon professional subjects, travel, personal experiences, etc.

Correspondence on matter of interest to the Corps, and articles of a non-scientific character, may be accepted for publication under a *nom de plume*.

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EDITOR

COLONEL G. W. WILL, *O.B.E.*

ASSISTANT EDITOR

LIEUTENANT-COLONEL J. C. BARNETSON, *O.B.E.*, R.A.M.C.

MANAGER

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PRINCIPLES OF SURGERY IN THE FIELD INCLUDING TRANSFUSION

BY

Brigadier D. FETTES, O.B.E., K.H.S.

Consulting Surgeon to the British Army

THIS talk will be on professional matters but I hope that every professional matter discussed will have an important administrative aspect.

The Senior Officer however employed must know most things about surgery if he is to be of value as an administrator whether the country be at war or peace.

I went into a hospital overseas the other day and found two cases with each finger immobilized on a hand splint. Any inspecting officer should know that he ought to enquire the reason for that and should know that it is now one of the deadly sins to immobilize every joint of a hand because one finger is at fault. In the same way, in war if he is to avoid putting the wounded unnecessarily in jeopardy, he must know the accepted principles of surgery in the field. His must be the decision as to whether the ideal methods of treatment can be carried out and his must be the responsibility for accepting the inferior alternative. I make no apologies then for going into some detail in describing the ordinary treatment for an ordinary wound. Wounds other than ordinary are treated more or less on the same lines with modifications for some types—chest, abdomens, heads.

The first principle, and it has been stressed after every war we have taken part in during this century, is early and adequate surgery. The day of excising skin is over, only frayed edges are removed. Skin is very valuable, and it does not matter how far the wound is extended longitudinally, the bigger the opening the better, one can get at the damaged tissues in that way. It does not matter how big it is because the administrative officer is going to see to it that the case will be moved on at the right time so that in a very few days it will be closed from end to end and proceed to heal. There must be no

tension at all so deep fascia must be incised longitudinally and transversely also if need be. Then all devitalized muscle and everything foreign must be removed. Wounds heal all right without penicillin and without sulphonamides. They did all right in 1918 but they go catastrophically wrong if any dead tissue is left behind and nothing given orally or by injection, whether it be penicillin or sulphonamides or what you will, can ever reach tissue which has lost its circulation. All the shattered fragments of a bone left unattached used to be removed, now these fragments are carefully conserved as a scaffolding so that with good surgery and penicillin they will act as a bone graft.

It all fails if the wound remains open, but under reasonable campaign conditions, these wounds will be closed. Fixation these days is by plaster and whenever a plaster is used there have to be very strict rules so that if a limb swells under the plaster it will still have room. The worst preventable catastrophies seen in war are the gangrenous limbs, gangrenous because the plaster was not split for a journey. The severe flesh wounds need fixation, the bony injury of course must have it. Fixation is by plaster, add the Thomas splint, combine the two in the Tobruk plaster and we have all the fixing apparatus required. Vitally important and life saving they are. Three main principles then are involved in the treatment of wounds :

- (1) The relief of all tension.
- (2) Removal of everything foreign and devitalized.
- (3) Fixation for evacuation.

This means that wounds are left open during the period when the body is mobilizing its defences against invasion. That is the first stage of the two-stage operation.

I have said once or twice already that a wound however large will be closed. The wound left open will become infected with suppuration and all its ills resulting. Skin is the best wound dressing. The closed wound, closed by suture or other form of wound cover, will heal. Ogilvie says that any wound left open for more than a week is a reproach. For the second stage of the operation the wounded man is moved on after primary operation to a centre where he can be held. Ideally he should reach that centre on the second to the fourth day so that the wound can be closed on the third to the fifth day. These are the optimum times. After a week the process of scarring has begun and secondary closure becomes a more complicated procedure. The cases, when closed, remain where they are. If they have to be moved the wounds go wrong. Stitches and ambulance journeys are incompatible. Stitches are removed on the tenth to twelfth day. Exercises are commenced next day. The cases are fit in a week for Convalescent Depot.

Over 90 per cent of wounds should be closed successfully and uncomplicated wounds, however big, should be thoroughly healed in three weeks. There are many benefits from treating wounds in this way.

- (i) The lightly wounded are got back quickly to work.
- (ii) Hospitalization is cut down by 50 per cent to 60 per cent.
- (iii) The wounded get back to a higher category than they used to.

- (iv) Wound dressings are cut out and the cross infections which go with them.
- (v) All this without mentioning the prevention of pain and suffering and the late sequelæ of osteomyelitis. There is a non-adherent linear scar instead of the distortion and troubles which result from scarring and chronic infection.

That then is the treatment of wounds in general—the ruthless sacrifice of muscle and other tissue which is no longer of value but is a danger because it has lost its vitality. If any other rule is accepted it means gambling against blazing infections and gas gangrene of the 1915 type. Yet in some campaigns the surgery can be less mutilating and safely so, but it takes an expert experienced Consulting Surgeon with a Force to lay down rules for or to some extent against ruthless surgery. Wounds did very nicely in South Africa without it. They tended to do comparatively nicely in Palestine in the 1914-1918 War, while at the same time in Flanders, the story was of frightful infections, gas gangrene and tetanus. They did very well on trimming operations in the African campaigns of the recent war, but stepping over the water into Sicily changed the whole picture. The whole surgical policy had to be changed and there was no consulting surgeon there to change it because the C.-in-C. apparently would not have one at the start.

Commanders-in-Chief have learned a lot. They know something about preventive medicine. Some of them know the true meaning of the word hygiene, and they ought to know that the wounded who have fought and may die may live if there is a consulting surgeon skilled and common sensed. I emphasize this because I have heard it emphasized so often by the leaders in the civilian profession. No consulting surgeon asks to be regarded as the teeth of the Force. A commander needs all the teeth he can take with him on his campaign. He should not leave any part of his frontal lobes behind.

Policies may have to be changed to suit conditions. Operationally, wounded may have to be moved when surgically they should be held. The journey to the base may take three hours over a perfect tarmac road; it may take three weeks over a wilderness. Wounds may have to be kept open, freely draining into plaster cases but even so their closure later by a different technique becomes all the more necessary. Methods must be flexible to suit conditions but the methods must all be proved ones—proved in all climates and conditions.

Then we should not expect to start a new war with the surgical triumphs which were the rule at the close of hostilities in 1945. We cannot count on having experienced surgeons. Already the Tobruk splint technique and the necessity for closing the sucking wound of the chest have to be taught to those now practising war surgery. We cannot count on lease lend with everything provided nor can we count on victorious conditions with all the benefits which accompany them—the possibilities of full resuscitation, the ability to hold, the air ours not theirs, good nursing, special centres sited where we want them. Reverse the process, with the British Army on the run, an enemy

around and above them and all the old terrors of infection—which incidentally we know all about—will return.

Now a minute or two about wounds in special sites.

Abdomens.—Delay is as dangerous as ever but chemotherapy does hold infection in check to a little extent and justifies a little delay. Certainly it justifies the essential delay of $1\frac{1}{2}$ –2 hours during which a case is being resuscitated.

Dominating the whole position is the vital question of whether or not the case can be held for at the very least a week after operation. It is one of the most difficult decisions, but it must be faced, choosing whichever course is least likely to result in the death of the patient.

- (i) Immediate operation with risk of his compulsory transfer in a day or two,
- or (ii) At the expense of very valuable time, transfer him for operation where he can be held.

The scales are weighted too heavily. It is little exaggeration to say that if he has to be moved early, he dies; whereas if held, with operative technique and post-operative care as practised in 1945, he has a far greater chance of living than of dying.

Reluctantly I must refrain from a fuller discussion of techniques—gastric suction, etc., which have resulted in this improvement.

Chests.—The sucking wound of the chest is one of the few examples of a wound which requires far forward surgery. The to and fro suction must be stopped by dressing or operation. It is a good example of a life which can be saved by a stretcher bearer. Incidentally, it is often not realized that the stretcher bearer does much more than just collecting and carrying. The way the patient is handled from the battlefield to the operating theatre can materially affect the mortality rate especially in abdominal wounds. The sucking wound travels badly but he should be got out of the forward noisy area.

The first few days of the treatment of a chest wound are better left to the general surgeon, who resuscitates, corrects the disordered physiology and diminishes the risk of infection. The physician has an important place in the team, the proper aspiration of hæmothoraces is of very great importance in preventing or controlling infection and ensuring the return of lung function. The surgery is as described for wounds in general but does not deal with lung damage nor with the fragment which caused it. The damaged lung is collapsed, does not tend to bleed, and is not prone to gas gangrene infection. Its treatment is deferred until the case reaches the chest centre. The latter wants the case early, but if conditions are difficult and the case does not reach the centre for seven days, it will still have arrived before important complications are due.

I must again avoid details, the modern treatment of infections, the great part played by anæsthetists in development of chest surgery, the routine rehabilitation.

Heads.—Head wounds casualties do not suffer from any marked degree of shock unless associated with other injuries, and do not require transfusion or

respond to it. Pain is not a feature unless there is compression, and they travel well. Penicillin controls infection in the extradural tissues and sulphadiazine deals with the cerebrospinal fluid. Head wounds do not therefore need the high priority in treatment that was once insisted on. It is generally agreed that when the dura is penetrated the case has a better chance of uncomplicated survival if a neuro-surgeon operates on him and the rule has been that if the case can reach a neuro-surgical centre in seventy-two hours, with chemotherapy meanwhile, that should be the method of disposal.

When that is impossible and when a head wound is associated with other injuries, e.g. abdominal, the general surgeon becomes responsible, and so in addition to Neuro-surgical-Maxillo-facial Centres with Ophthalmologists and Otolologists completing the team, certain of the general surgeons at other hospitals must be trained and sufficiently equipped to deal with head wounds.

Chemotherapy : There are one or two axioms :

(1) Chemotherapeutic drugs given systemically can only reach those tissues which have a blood supply.

(2) There is evidence that sulphonamides given orally, whether they can affect lacerated tissues or not, do reduce systemic infections, both penicillin and sulphonamides are therefore still required. I have considered recently that the methods practised in 1945 might be due for some amendment. My views have been as follows and I recently submitted them to the Medical Research Council.

(a) The wounded patient need not be wakened for a penicillin injection every four hours during the journey, but a larger dose, say 250,000 units twice daily, might be considered sufficient.

(b) That sulphanilamide is still the sulphonamide of choice for oral administration in that it is effective against the streptococcus and is the drug least likely to result in renal disturbances under all tropical conditions.

(3) The necessity for local treatment of a wound with penicillin-sulphathiazole is open to argument if surgery has been adequate ; penicillin is given parenterally and sulphanilamide orally. This does not refer to head wounds. In them sulphamezathine locally is an accepted principle.

(4) The sulphanilamide and penicillin labels may now require amending and might be combined, the red sulphonamide on one side and the yellow penicillin on the other.

I have just received a reply on these points from the Medical Research Council. They have been submitted to Florey, Colebrook, A. A. Miles (who was a director of the former Wound Infection Research Unit) and Long at the National Institute. They are fully agreed on the following points :

(a) That 200,000 to 300,000 units of penicillin should be given to the wounded at intervals not exceeding six hours. They point out that a dose of this magnitude should be dispensed in sterile distilled water of a volume not less than 5 c.c., otherwise the injections will be painful, since the solution will be markedly hypertonic. (I am not convinced that this works out in practice.)

(b) That a penicillin sulphonamide powder should be applied locally to the wound at the first and later dressings. All concur in thinking this important.

But while Florey and Colebrook suggested sulphathiazole powder for the purpose, Miles and Long think it would be better to apply the penicillin in a mixture of sulphonamides so as to lessen the risks of sensitization and of anuria. They suggest that a powder containing penicillin sulphamerazine sulphathiazole and sulphadiazine should be tried.

(c) All the advisers are almost unanimous in considering that sulphanilamide should not be given orally, only Colebrook seems to think that anything can be said in favour of it and even he is extremely lukewarm. Florey is flatly against it. The others consider that they would not advise sulphatherapy by mouth but that if it is decided upon it had better be in the form of a mixture, but they consider it to be really better to omit it altogether. (This advice will require grave consideration and no steps can be taken to implement it until the Advisory Committee of Surgeons have had full opportunity to discuss it.)

(5) *Air Transport*.—We started off the last war by calling certain cases suitable and certain unsuitable and allotting priorities for those suitable :

- (1) Maxillo-facial.
- (2) Burns especially of hands and face (after shock overcome).
- (3) Perforating wounds of the globe of the eye.
- (4) Limbs and Joints.
- (5) Heads.
- (6) Spinals, etc.

We soon placed at the top of the list eye injuries in which the iris was prolapsed with the wounded man in the gravest danger of losing his vision.

We raised, then lowered in priority, the heads, having come to the conclusion that with chemotherapy, even if it took three days to reach a head centre, all would be well.

We listed as unsuitable for air transport :

- (1) Those shocked or likely to develop shock (giving them twenty-four to thirty-six hours' treatment first).
- (2) Abdominal and thoracic wounds.
- (3) Recurrent severe hæmorrhages.
- (4) Acute abdomens.
- (5) Gas gangrene before treatment.

Several of these obviously are unsuitable for high altitude flying. Anyone who has flown at 12,000 feet with a full fountain pen in his pocket knows what happens to a container containing air and fluid when atmospheric pressure drops. To say the least, it is obvious that there will be serious disturbances within the abdomen and thorax.

But by the end of the war we had come to the conclusion that there was only one type of case which did not travel reasonably well and that was the wounded abdomen which had had an adequate surgical operation.

Certain others are all the better for preliminary treatment and chests are all the better for being held during the first five or six days, but as in all other aspects of war surgery, often the correct treatment and disposal is a counsel

of perfection and very often the lesser of two evils has to be chosen, the ideal being ruled out.

But abdomens are the exception. It must not be forgotten that the case operated on and moved within a week, whether by air or ambulance or any other way, is very, very unlikely to do well.

(6) *Transfusion*.—The choice of fluid is limited by campaign conditions. Severe blood loss demands replacement, and in such conditions blood is two to three times more effective than plasma. It not only brings the blood volume up but supplies hæmoglobin necessary to combat infection. When it is plasma that has been lost as in severe burns and crushes, the indication is for plasma. But blood has to be distributed from refrigerators and there will always be difficulties connected with transport and storage in forward areas.

Only stored blood is available in forward areas as a rule. The clinical response is better after fresh. After stored blood transfusions, reactions are more frequent, infection is more liable, and so dried plasma is the best solution to the problem there. Plasma, when the exigencies of the service demand its use, is a life-saving substitute for blood, but not one devoid of risk. Obtained as it is from large donor pools, it may be contaminated with icterogenic agents of infective hepatitis and homologous serum jaundice. It is an important risk, for contamination may result in an incidence of 10 per cent sometimes with fatal cases, and the incubation period being very long, the damage is done before discovered.

We should therefore use plasma only when it is really indicated or when blood is not immediately available. Recently in Hungary I felt compelled to talk at length on this subject when the French were boosting plasma as the perfect answer, and the satellites were boosting the Russian policy of using corpse blood. My views were quite new to the audience.

Without going into details, one or two points might be emphasized. Advanced wound shock is irreversible. If a case is transfused and the condition allowed again to deteriorate, a second attempt to resuscitate is much less likely to be successful. It may be a mistake therefore to transfuse too far forward. The aim should be to transfuse so that the patient reaches the optimum time for operation at the time when surgical facilities become available. If a patient resuscitated has to undergo a journey, deterioration may be prevented by continuing transfusion by drip during the journey by ambulance car, plane, etc.

TRAINING FOR AND HYGIENE IN THE JUNGLE

BY

Lieutenant-Colonel J. J. O'DWYER, C.B.E.

Royal Army Medical Corps

It seems to me to say anything about hygiene in the jungle which has not already been expressed more adequately than lies in my power, is quite impossible. Perhaps the articles by Brigadier Marriott in the *Lancet*, the *B.M.J.*, and the *Army Quarterly*, set out these problems and the answers to them so clearly that they come most readily to mind. The abundance of literature on specific problems as for example malaria and its suppression by drugs, scrub-typhus, its clinical aspects, and the value of miticides notably dibutyl phthalate, the lack of opportunity to test the validity of the laboratory tests on the scrub-typhus vaccine, the prevention and early, very early, treatment of bacillary dysentery and the avoidance of amoebic infection by filtration of water and an adequate discipline among food handlers are all known to you. You will find the need for all these measures stressed in the exercise. We realize the importance of knowing the meaning of the word "Hygiene," and of realizing the scope of the activities and responsibilities of the Army Hygiene Organization. The definition of Hygiene given in A.C.I. 605 of 1948 is: "The maintenance and enhancement of mental and physical health and efficiency, and the prevention of disease." Perhaps the definition could be said to be tautological, since unless disease is prevented, health, mental and physical, will neither be enhanced or maintained, but the tautology has its uses and serves to remind you and me of the secondary but very important duty we have to perform, viz. to investigate, and practically to apply in peace and war, any new weapon in the doctors' armamentarium of disease prevention which we can find, no matter who discovered it or when.

But we knew in 1939 how important was the definition of the word Hygiene and you and I had achieved a competence in the prevention of disease, yet the figures before you in that chart (now the story of an old campaign) show that there was a lamentable failure in the application of our knowledge. I think that the main value of the pictorial representation of the trends in sickness in what was eventually regarded as the Far Eastern Theatre of war is not to show ourselves or others what a very fine job we did in the years 1944 and 1945, but to show us that our work in 1943 and the first half of 1944 made a poor showing. Old campaigns are only worth studying if we recognize in them our failures as well as our successes and if we are prepared to analyse those failures so that we will not be forced to admit failure again.

In this instance we are fortunate in that while the circumstances of 1943 cannot in the nature of things occur again, the principles and practice of the

work then attempted will apply in any war conducted anywhere. What do I mean when I talk of a failure? Sir Shelton Dudley wrote as follows in the R.N. Bulletin No. 19: "No one admires more than I the efficiency of the equipment and the medical organization which the Army Doctors had devised to prevent the field diseases which have wrought such havoc in former wars. Yet the same diseases became almost as great a menace in the early years of the Japanese war, because the combatant officers had not been properly taught the value of applied hygiene as a factor in the success of military operations." In the war of 1914-18 we learned at least three lessons:

- (a) That malaria can and does wreck a campaign.
- (b) That dysentery can do the same.
- (c) That the soldier, if he is to fight well, must be well fed.

During that war and during the inter-war years, we had learned how to keep malaria down by preventing the mosquitoes from biting one, how to cut down dysentery by simple water-purification methods and good sanitary discipline and how to feed a soldier so that his diet contained all nutritional essentials and an adequate calorie value. Then look at the chart and we see what our sick-rates were in 1943. Malaria—incidence approaching that attained in Salonika; dysentery—well, the hospital figures give us little light on the vast extent of our infection rates which were so deplorably high; remember the epidemic of Imphal, the feeding of our Indian and our British troops was so poor that many of them showed the grosser signs of avitaminosis not to speak of loss in weight from the caloric insufficiency of the diet. The whole mounting to a toll of death and disease which was not and never will be accurately computed. I would remind you of some incidents of those days, not to harrow you, but to give point and emphasis to what may be termed somewhat wild general statements. In September 1943, four Units of British troops were seen by a Nutritionist in Imphal; the percentage showing obvious, therefore gross, signs of B. group avitaminosis varied from 15 per cent to 50 per cent. At the same time any observer would have found that the figure for Indian troops varied from 30 per cent to 90 per cent. In a visit to a unit of Indian Pioneers in which the dysentery rate was about 3 per mille per day I was informed by a medical officer that the unit consisted of Madrassis who always had dysentery because they used such a quantity of curry and condiments in their food. I saw their quarters, their cook-house, their latrines, and the midday meal which was being sent out to them in the area in which they were working and their dysentery rate was no surprise. In August 1944 we had some 400 cases of virulent smallpox in an Army of about 500,000 men. I myself saw two cases in what was called a smallpox hospital. It lay some ten yards away from a main road, much used by pedestrian and wheeled traffic, wherein the attendants showed no signs of recent vaccination, wore no gowns, not to speak of masks, had none to give to visitors and where visitors were allowed to enter as they pleased. The hospital was commanded by a Regular Officer in the R.A.M.C. of many years' experience. The same lack of simple essentials was the reason for the infection with smallpox in another medical

unit of a medical officer, a sister and an orderly. I read in those days what others saw. I remember a report written by an American friend of ours who for long fought hard for our requirements in Washington. He saw some of our medical units in an L. of C. area and asked for permission to be frank. It was gladly given and he reported that to his great surprise many medical officers, British and Indian, seemed to forget that purification of water supplies before the water was used for drinking and washing was essential in the tropics. The careless cynicism of some appalled him. The attitude to the protection of patients from mosquito bites in base areas where such protection was more than ever necessary was so slack that the D.M.S. was forced to drastic action in many medical units.

You will remember as I do, the gallant strivings and the great success of a large proportion of our officers and men, but the instances I have mentioned, perhaps extreme examples of ignorance, carelessness or irresponsibility, did much to undo the hard work of others and were an indication of a failure to realize a primary responsibility of the Army Medical Services. However, these examples if they are taken in conjunction with other evidence available and known to you, and to me, of the attitude of mind towards hygiene and sanitation may be of value.

In the years 1939 to 1942 I was given by my then D.D.M.S. what might be called a severe training in hygiene and sanitation, and the duties and responsibilities of a hygiene officer. I needed it, despite the gallant efforts of my teachers in Millbank, to make me work and think. I well remember visiting with him a number of hospitals and seeing some wards full of patients with minor respiratory tract infections and being asked "Why are these men ill? Why are they in hospital? Have you sought the help of the Clinicians in investigating the causes, or of their C.O.s in endeavouring to find a remedy?" Contrast this with my experiences in 1943 when some of my seniors informed me that medical officers were wasted on hygiene duties, that a hygiene officer had nothing to learn from or teach to medical officers employed in hospitals and that they had little or no faith in the recommendations made by our hygienists for the prevention of the diseases causing those horribly high casualty rates. This perhaps you may say was my own fault and that of my colleagues—A.D.s and D.A.D.s of H., who served under me. That I will not admit. I refuse to take the whole blame for those reactions to my colleagues' work or mine. The attitude and the reactions deserve, however, our careful examination. If such were the responses of even a small minority of the Army Medical Services as indeed was the case if the outward manifestation of those reactions was a very low standard of sanitation in some medical units, they merit our attention. When in addition we consider that officers holding these views were, in some cases, responsible for advising combatant commanders, analysis of the reasons behind these attitudes becomes essential. How could we expect unit sanitary discipline to be high when the authors of it, i.e. the Army Medical Services, were not themselves believers in it, much less apostles of it, or exemplars in the practice of it. The division of opinion was of course deplorable, the lack of example notable and often commented on.

What were the reasons ? I feel that in considering our failure we must go back to the beginning of our own medical training. When I was a student, and I have little doubt that the same applies to every doctor in this room, my fellow students and I received a first-class training in curative medicine. That training revolved in the main around the hospital and the bedside, and somewhat round the laboratory then, of course, the bacteriological laboratory. I was never taught to correlate the illness of the man, woman or child in bed with the patient's environment, physical and mental. It was never explained to me that in the city in which I worked the infant mortality rate was the highest of any large town in the United Kingdom, therefore, those children who survived the first dangerous years would, many of them, suffer from illnesses that would turn some of them into adolescents and adults fit only for half a day's work, and unfit for Army service and many others into low standard recruits.

I was never taught that my responsibilities as a doctor should lead me to attempt, in however feeble a fashion, the general health education of my patients. That conditions have little changed since the early days of the 1920s is evidenced by the description given in the report of the Goodenough Committee on Medical Education, which describes the undergraduate training in hygiene, public health, social medicine or what you will as "In most of the schools the scope of the teaching is too limited, the attention paid to the promotion of health and the prevention of disease is often perfunctory and largely divorced from the rest of the student's training." So we start with a handicap, and a heavy one. But, you will say, the Army provides the answer. The R.A.M.C. trains us in hygiene, gives us in fact a training second to none. But no training can be of real value if the trainee is not conditioned to it and while even we of the Regular Army were, many of us, lacking in appreciation of essentials, how could we expect others to be aware of hygiene and sanitation until driven to awareness by disaster or something very close to it. It is well to examine our own consciences on our willingness to admit the importance of hygiene training.

I think first of all that the attitude of many of our officers bears a fair measure of the many doctors' inability to get away from curative medicine, their disinclination to broaden their horizon so that they should appreciate that theirs was a responsibility making it necessary for them to advise the laymen on all aspects of the soldier's life, his work, his surroundings, his clothes, his accommodation, the employment of his leisure time, the impact of training on his mind, the relationship of the man, his N.C.O. and his officers, his morale.

If the medical profession took a narrow view of its responsibilities and had in many cases little belief in the remedies and courses of action laid down for it by its own organization, courses investigated, believed in, and pronounced upon by its own specialists, what chance had the Army as a whole of being adequately trained in hygiene and sanitation ? Do you remember the type of N.C.O. and Pte. sent to courses on sanitation and water duties from the efficient units of our Army between the wars ? Do you remember the attitude of somewhat irritable boredom with which we regarded these cranks, the hygienists, and their babies, the School of Hygiene and the Hygiene Depart-

ment of the College. "Common sense is all that is required" was the common catch phrase. No mention of the hard work necessary to ensure that the sense becomes a common factor. But courses were given and enthusiastic officers taught us all; but because of our interest in curative medicine, to the exclusion of all else, full value was not taken and because man is human, therefore, not even always given.

We started, I have the impertinence to say, with two severe handicaps:

- (a) The medical training given to us as undergraduates.
- (b) Because of this training, a state of mind often refusing to admit that great importance should be given to medical sciences other than those involved in curing a patient's hospital illnesses.

These led to a dampening of enthusiasm in pressing hard for a vigorous health educational programme, first of all for the Medical Services and then for the rest of the Army. Make no mistake about it, the training of the Army in hygiene will never be achieved unless the Medical Services are one and all convinced of the need for such training and have the knowledge and enthusiasm to regard it as a primary responsibility.

Let us go back again to Sir Shelton Dudley's statement: "The combatant officers had not been properly taught the value of applied hygiene as a factor in the success of military operations. In this respect the final success of the R.A.M.C. in replacing the combatant officers' early indifference and apathy and gaining their enthusiasm and support for hygiene, is to me the most remarkable achievement in military hygiene." Taken in conjunction then with what has gone before, let us see how that "enthusiastic support" looked to us in 1944. A significant pointer is given in the answers made to a questionnaire devised in G.H.Q. India and submitted to a large number of officers in India Command in 1944. By this time propaganda, well devised by the Headquarters, given full backing by the Commander-in-Chief, and appreciated by a large number of very senior officers, medical and lay, had been going for almost a year. The result was that as regards malaria approximately 60 to 70 per cent of the officers of the rank of Captain and below were not able to answer some very simple questions asked. The percentage fell to about 50 per cent among Majors and rose again to about 70 per cent among Lt.-Colonels, i.e. officers commanding units or holding senior staff appointments. What had happened? It was obvious that despite backing from the highest quarters, and General Wavell making it plain that the defeat of the Japanese depended on the defeat of malaria, *we, the Medical Services* had not got our ideas across. Why? First of all we were not as a body, united in our conviction of the need for strict antimalarial discipline. That was only achieved when Brigadier Hamilton Fairley proved to the combatant forces of the world, the Brigadiers and Generals of fighting divisions, the important commanders of military areas or bases at home and abroad, that despite the disagreement of some of the medical authorities on the value of mepacrine an answer had been found to one of our gravest problems.

But our task is now made easier. Let us consider some of the advances

which have been made in the last ten years and how they can help us in our duty of keeping the soldier fit in the tropics.

(a) *Acclimatization*.—The old delusions about the effects of the sun and methods of working in heat have gone by the board. The tyranny of the topee is no more. Perhaps one of the most striking things which the soldier of sixty years ago would have seen if he came to the Far Eastern Theatre during the last war, was the sight of men walking about in the sun, bare to the waist, sometimes without a hat, working really hard all day and every day. Our figures for sickness as a result of effects of heat were negligible. How is it done? Many have worked on the problem and a paper published by Professor Hill of Queensland University about 1943 comes to mind. A period of acclimatization of three to four weeks during which graduated work is done in the heat and the sun beginning with periods of minutes and ending up with whole days. At the same time, many of us can become sun-tanned slowly and gradually, but it is necessary to remind officers and men of the danger of sunburn and the need for great care in the case of men with a very light skin. At the same time, it is often possible to begin this work on board ship. Above all, when it can be done, men on board ship should wear boots or leather shoes instead of rubber-soled canvas shoes. The need for this was borne in on me when in Malaya in 1942 a British Division landed and after eight days was sent to fight in the jungle. The men had been voyaging in crowded troopships for some eight to twelve weeks and had been in gym shoes for most of that time. I went down on a number of occasions to see the men coming in sick and wounded on the Ambulance trains, and almost without exception their feet were pitiable to see. A warning I have never forgotten.

(b) *Mepacrine or Paludrine*.—Little need be said except, perhaps, to stress again the fact that when mepacrine was taken, the malaria rate was negligible. Where discipline was poor and the mepacrine was not consumed, as happened to two divisions in the Far East and, I am told, one Australian division in New Guinea in 1945, the malaria rate rose again. A rise in the incidence of clinical malaria in formations on suppressive treatment means poor discipline, a negligible incidence means good antimalarial discipline.

(c) *D.D.T.*—If ever a new invention changed an environment *in toto*, it was D.D.T. The change wrought in tropical camps by the use of D.D.T. was most remarkable. Each became an entomological vacuum free of flies, mosquitoes, bed bugs and cockroaches. It made a most remarkable difference to one's living conditions except in the front line and here there was some difference because the new repellent *di-methyl phthalate* really did repel mosquitoes.

(d) *Sulphaguanidine*.—Sulphaguanidine may not be the most efficient treatment for bacillary dysentery, but I think three advantages should be borne in mind before a change is made to any other compound.

- (i) The low toxicity rate. Despite the fact that some hundreds of thousands of our troops were treated with large quantities of sulphaguanidine, the number of those who showed signs of lack of tolerance of the drug was negligible.

- (ii) The suitability of the drug for use by non-medical personnel in very forward areas because of its non-toxicity and because it could be given with safety to men likely to become dehydrated.
- (iii) Availability. When a drug was required, sulphaguanidine was available from Australia in large quantities. It cannot be replaced in our armamentarium unless its successor is likely to be available in similar quantities.

(e) *T.A.B. Vaccine*.—Once more we were saved from any real worry regarding the effect of enteric fever on our troops as regards its power of causing large numbers of casualties.

(f) *Vaccination*.—It would seem to be necessary judging from our experience in the last war to include as an essential in our health education insistence on the need for vaccination. Nothing roused me more to anger than the death of young British officers and men from hæmorrhagic or confluent smallpox. They arrived from the United Kingdom to countries where virulent smallpox was endemic and epidemic, certified as having been vaccinated, only to die of smallpox. I remember well the case of eight young men in the Royal Corps of Signals (one officer and seven other ranks), who did not spend the usual month in India before going into Burma. Within four weeks of arrival, six of them had become infected with smallpox and four of them died. I saw the officer some thirty-six hours before he died; he told me that he and his men had been vaccinated by a civil medical practitioner in the United Kingdom, had forthwith been certified as having been successfully vaccinated and never been examined again. This carelessness in regard to vaccination will not become less when one considers how small is the risk these days of contracting smallpox in the United Kingdom. The latest Ministry of Health memorandum draws attention to the fact that it is not advisable to give primary vaccination except during infancy to a population exposed to such a very small risk of infection with smallpox, as exists in the United Kingdom. This underlines our Army difficulties, and the need for careful propaganda on smallpox risks abroad and the value of vaccination.

(g) *Feeding*.—Though in the Far East we suffered much in this last war from lack of opportunity of feeding adequately many of our troops, notably our Indian troops, many problems have been solved and the advance in the value of packed rations as food, the palatability, and variety of such rations has been enormous and was of course due to our intimate contact with United States methods. The development continues in civil firms and as far as British troops are concerned there should be no difficulty in the future. We had little or no difficulty in feeding our East and West African troops because they were able to eat and enjoyed food supplied for our British troops, but research is required into the question of the adequate feeding in peace and war of our Gurkha troops.

Many other advances have been made which make war in the tropics a very different problem to that set for us in 1914 or even in 1941, and the use of these advantages is not a matter for us but a matter for every officer and man in our forces. This is realized now as never before and the Director-

General has given me permission to quote from the personal notes sent to all Commanders attending Exercise BAMBOO by Viscount Montgomery, lately our C.I.G.S., regarding the importance of health measures.

"Troops if they are to fight with success in tropical countries, must be well trained, highly disciplined and acclimatized. . . ." "Medical planning must ensure that hygiene discipline is instilled into every soldier. Inter-service teams will engage in medical research to overcome the diseases to which Armies are exposed in the tropics and medical intelligence about every tropical country will be made available to our Medical Services." "Strict hygiene discipline is essential." "Personal hygiene and the taking of drugs is a matter of unit discipline and *esprit de corps*." "A lack of health discipline is a sign of a fall in morale." "The three essentials for waging war in the tropics are first Army discipline, shown by attention to saluting, second, to health discipline, third, fire discipline."

Never has the need for health discipline and health measures been so understood and so stressed by our senior commanders—a remarkable achievement. The Medical Services on that account cannot, however, raise their hands and say "Ah well, it's our business no longer." Unless fostered by a firm belief in the value of health measures, unless taught and advised adequately on how to apply them, the soldier in a very few years will forget the dreadful lessons taught us in the last war. Soon, indeed it is happening already, those who speak of the learning of these lessons will be regarded as old fogies by those who never experienced the miseries of 1942 and 43 in the Eastern Theatres. It is up to each one of us to know what can be done to promote the health of the soldier, how it can be done, and the need for so doing. Then we can pass on the lessons in season and out of season, in talks, lectures, and exercises, in barracks, and in messes, and above all we must teach the young officer in the service what he has had no chance of learning in civil life, the value of hygiene to mankind in general and above all its value to the Army. It is our duty whether we are surgeons, physicians, pathologists, radiologists, ophthalmologists or otologists to ensure the training of all ranks of the R.A.M.C. in hygiene, and special emphasis must be laid on the teaching of young officers.

As far as we are concerned, there are a number of reasons why our training in particular should ensure that the R.A.M.C. as a whole, reaches the highest standard attainable, whether as individuals or as units. We must set an example to all others in health discipline. Unless we do so, we stultify our teaching, and expose those who come under our care as patients, to risks which medical units in particular can easily nullify. Our training must run parallel with the rest of the Army, but attain a high peak of efficiency if we are to perform conscientiously our medical duties in the tropics. At home, the Army must prepare itself in theory for work abroad. On board ship acclimatization will have begun, and training in the need for health measures will be intensified. Never again must we willingly expose the youth of our Kingdom to the horrors of severe smallpox without vaccination or to severe enteric fever without inoculation.

On reaching the tropics, training begins in earnest and the difficulty to

be experienced in such training in peacetime is a very real one. On the one hand is the desire and the great need that training should be real, that the training should face the soldier with the same health risks that face him in war, in other words that while given all the means that are now at our disposal for the prevention of disease, training should be carried out in disease-infected areas. On the other hand, there is our desire that men should not be exposed unnecessarily to disease risks. We must never forget that such exposure is an essential part of training and if the Army is to retain a vivid idea of what disease risks await them, training must be carried out under war conditions of terrain, climate, equipment and in hyperendemic malarious areas wherein scrub-typhus will be encountered from time to time. Only thus will health discipline be put to the test and only by the successful outcome of such tests can the quality of our training and health propaganda be judged.

In such training, medical units and personnel must take part and be able to show a live example to the rest of the forces.

To sum up :

(a) We failed prior to 1943-44 to appreciate the problems set us by warfare in the tropics because of a lack in our basic medical training and because of our lack of use of the hygiene measures at our disposal.

(b) Because of these reasons, we failed to convince the combatant that hygiene was to him of vital importance.

(c) We can overcome the difficulties still facing us if we continue to realize the scope of the problem, if we are at one regarding the solution and if we set our example to the rest of the Army in the use of the measures we know to be essential.

DISCUSSION

In the discussions which followed, the Director of Hygiene stated that, contrary to the statement made in the papers in regard to this Exercise, no developments were in progress with a view to replacing the netting used for the ordinary large nets by the wide mesh type.

The reason for this was that experiments had shown that while the wide mesh netting impregnated with D.M.P. close to the skin was protective, it was not successful at a distance from the skin as was the case if it was used for large types of nets.

The Director of Hygiene mentioned that the present issue of bush net had been under consideration and that a new design had been produced at the R.A.M. College after inter-service discussions on the subject and a prototype of this was being developed by the Ministry of Supply for preliminary trials. The policy was to produce no more sandfly nets as such and to rely on the spraying of the ordinary mosquito nets D.M.P. to deal with sandflies. This procedure had been proved to be satisfactory in the Middle East.

The Director of Hygiene continuing said that everything possible was being done to improve health education throughout the Army. Measures had been taken in respect of recruits, cadets at Sandhurst and O.C.T.U.s and

officers attending courses at the School of Military Administration and at the Staff College. In addition, the subject had been included in the syllabus for officers taking the examination for entrance to the Staff College.

The Director of Hygiene made special mention of the introduction of special courses in Military Hygiene for corporals for promotion to serjeant and captains for promotion to major. He said that this had been approved in principle by the D.M.T. some time ago but that up to the present the difficult circumstances in which we were had prevented the implementation of this policy. He hoped that before very long it would be possible to get it adopted.

The Director of Hygiene finally drew attention to the increasing importance of the man in relation to his environment and the environment in relation to the man from the biological point of view. He suggested that more teaching of this subject, even though on a very limited scale, was wanted throughout the Army, particularly in connexion with training in man management.

Referring to advances made with D.D.T. the Director of Hygiene said that a new emulsion concentrate of D.D.T. which was capable of dilution in any type of water or with kerosene was at present under trial in the Middle East and the Far East. He hoped that this concentrate would prove a satisfactory substitute for the kerosene solution for an interim period at all events. He mentioned the development of standard knapsack sprayers with a view to eliminating the many types of sprayers that we have at the present time and which did not altogether meet our requirements. He said that as far as atmospheric spraying was concerned, the intention was to rely on aerosol bombs or their equivalent for emergency use, and to dispense with flit guns. In other words, except in special circumstances, reliance would be placed on residual spraying. He indicated that developments were proceeding in connexion with the aerosol bomb and that it was probable that a low-pressure type of bomb, very much less expensive than the present issue, would be available before long as an expendible item.

D.D.M.S. Western Command urged that the wearing of rubber-soled gym shoes on board troopships should be forbidden as it was generally accepted they had a very softening effect on a soldier's feet. He advocated that rubber-soled slippers should be replaced by rope-soled slippers.

The Director-General then asked for comments of the appointment of a staff officer as D.A.A.G.—Health Discipline.

Colonel O'Dwyer in reply said that the duties of the D.A.A.G.—Health Discipline, consisted of visiting the various units and seeing that health discipline measures were being carried out in the malarial areas.

The Director-General said that it was essential that the individual commanders should take responsibility for the health of their men and that it was over-specializing to have a staff officer engaged solely on these duties.

THE PROGRESS IN PUBLIC HEALTH IN THE UNITED KINGDOM AS REFLECTED IN THE QUALITY OF THE RECRUIT VOLUNTEERING FOR SERVICE IN THE ARMY

A Survey of 65 Years: 1848 - 1913

BY

Lieut.-Colonel DEREK LEVIS, B.A., M.B., B.Chir. (Cantab.), M.R.C.S.,
L.R.C.P.

Royal Army Medical Corps

I

INTRODUCTION

It has recently been the fashion to recognize in the centenary year (1948) of the passing of the first Public Health Act a signal to review the progress achieved in Public Health in this country. It is the object of this paper to attempt something of the same thing and at the same time to seek amongst the information available from a selected portion of the community for corroboration of progress. The portion of the community selected is the British Army. The index of measurement chosen is the physical state and condition of the recruit presenting himself for enlistment. To meet the criticism that such an index of measurement is unlikely to be valid because the physical standards demanded of the recruit are not constant it will be necessary to restrict the period to be reviewed to those years when there was little or no fluctuation in the standards of physique which were considered necessary for a soldier.

Broadly speaking this is to be found in the years between the passing of the first Public Health Act in 1848 and the last year of peace in 1913 before the outbreak of the first world war. Between these years—within narrow limits of variation—the ideas underlying the enlistment of manpower into the Army were governed by the fact that the two basic skills necessary in a soldier were considered to be the ability to march and fight. His physique had to be in keeping with these. There could be no question therefore of enlisting any man with any degree of disability that would prevent him carrying out, more or less efficiently, these two duties. The period of dentures for the soldier lay ahead; the idea of repairing the hernia of a recruit was beyond contemplation; spectacles for the private man were not to be tolerated while job analysis with personnel selection and Pulheems Classification were as yet a long way over the horizon. Consequently the physical standards of this period were almost entirely confined to arbitrary details of age, height, weight, eyesight and chest measurement. Provided the recruit complied with the prescribed minima of measurement, in the clinical absence of any obvious physical defect, he was accepted for service.

There was therefore during this period a more or less UNIFORM standard of physical selection which does permit, to some extent, of an estimation of physical quality of the recruit material when the causes for rejection on physical grounds are examined. There is therefore provided a unit of measurement for the assessment of progress in National Health during a period of some sixty odd years.

A further criticism that can be levelled against the system of assessment is the one which would point out that the recruits for the Army might not be considered to be typical of the manpower of the country during these years. This again is true. The choice of the system of measurement and the period during which Public Health progress will be assessed with this measurement will, it is considered, meet this criticism. Between 1848 and 1913 the recruit for the Army was a volunteer. The class of society from whence he came was—bluntly speaking—the lowest. He came from a class which was subject to the environmental effects of the Industrial Revolution and which, as a class, felt the economic effects of a “laissez-faire” political economy. He came from the class on whose behalf Chadwick had fired the first shots in the Campaign for Sanitary Reform in this country—namely the Labouring Population of Great Britain.

The year 1848 heard the first salvoes of the barrage of sanitary, sociological and philanthropic effort which was brought to bear on just this one particular target. This barrage was crescendo for sixty-five years until 1913 when the growing threat of a major European War sent men's thoughts anxiously across the Channel.

This period 1848–1913 was the most formative in English Public Health history. Its beginning saw the emergence of a local Authority from the wreck of an aristocratic and rural system which had allowed events to catch it up and pass it; it felt the effects in its middle phases of the transfer of political power to a growing middle class with a lively social conscience; in its later phases it felt the effects of a widening enfranchisement of a working class that was beginning to be educated and organized for mutual help; at the end it was to see emerging the old Radical ideas of a national minimum of subsistence and their crystallization into a system of National Insurance. Throughout it saw the results of improved sanitation and environmental hygiene as they affected both home and factory. All through there was a steady attack on the conditions that surrounded one particular section of the people. And it was from this section that came the recruit. It is reasonable, therefore, to suppose that, as the imperfections of his living were attacked and reduced, so would his physical demeanour improve and reflect the social progress of his class as a whole. It is for this paper to test the validity of this hypothesis. The instrument for measurement has been selected and the period to which it will be applied has been chosen. The method of application will be mainly that of the study of the causes for rejection of the recruit on physical grounds. As far as possible particular attention will be paid to the rejection rates for those physical defects which might be considered to have their origins in the social background of the recruit and which might result from

those conditions against which the efforts of the sanitary reformer were mainly directed.

Improvements may not be immediately obvious. Reforms of the earlier years may perhaps only begin to show themselves towards the end of the period. The advances in medical science and the improvement in diagnosis as the years go by may be reflected in increased rejections of recruits as the identification of conditions prejudicial to military service becomes more certain. It is possible therefore that the gains on the one hand may be offset by the increased rejections on the other and the whole hypothesis prove unfounded. Nevertheless it is hoped that certain favourable "trends" or "shifts" in the frequency of certain causes of rejection with a social background may be demonstrable.

There can be no fixed ideas on this subject. In fact the words of the Committee on Physical Deterioration of 1903 give little cause for even thinking that such a method as the one proposed will clearly demonstrate improvement in the Public Health. They said :

"In short, the examination of the Official Representatives of the Recruiting System left upon the minds of the Committee the conviction, confirmed as it was by the evidence of other witnesses, that it would be as reasonable to argue from Criminal Statistics to the morals of the great mass of the people as it would be to argue to their physical conditions from the feeble specimens that come under the notice of the recruiting officers."

These are hard words and they were written fifty-five years after the First Public Health Act became law and after half a century of human endeavour had been given to improve the lot of the recruit-producing class. It is of some consolation perhaps to reflect it was these same "feeble specimens" who won and held an Empire for the Victorian Industrialist who may have been largely responsible for the very conditions that enabled this august committee to give them this derogatory label in 1903.

II

THE SOURCE AND SOCIAL BACKGROUND OF THE RECRUIT

1848-1913

It was Bulwer in his book "*The Monarchy of the Middle Classes*" who wrote "The English Army is recruited by volunteers from the working classes of England—that is to say, from the most destitute of a class, the great bulk of which is in a miserable state, and removed almost altogether, as well as from the habits and feelings of their country, from rising much above their native condition." This is an unpleasantly true statement. To join the Army at all events during the greater part of this period was regarded as the destiny of a failure. The well-established artisan or the small merchant on their way up to join Bulwer's Monarchy regarded those of their offspring who "went for a soldier" as lost for ever. They did on occasions, it is true, attempt to retrieve them from the clutches of the Recruiting Authorities by saying that their very act of voluntary enlistment could be taken as a sign of "lack of mental capacity" (a cause for rejection) but on the whole they preferred to

hush the matter up. Enlistment, up to the time of the Cardwell reforms, was for life or an unlimited period until invaliding or a reduction of establishment brought the wanderers home. The loose, intemperate and, on occasions, brutal behaviour of the soldier were long enough accepted and regarded as a normal state of things. No one who was any good enlisted or if he did he came to no good. What was it then that filled the ranks ?

The drums and fifes of a gay-coated Regiment parading through the market towns at fairs and hirings attracted a small proportion of the idle and irresponsible and even occasionally the youngster who had dreams of a martial career. In the 'sixties recruiting parties were advised to explore the possibilities of the neighbourhood around the stations of the new railways since such areas always were a rendezvous for the idle and unemployed. Often, too, a series of sad little reasons so common in certain sections of the community would help to swell the ranks. Trouble with a girl ; a quarrel with parents ; minor delinquency or the result of a drunken spree only too often to be regretted in the grey realities of the chambers of the attesting magistrate the next day. But taken by and large the main impulse that lay behind voluntary enlistment was the poverty which environment, sickness and the ill-understood cycles of booms and slumps had contrived to produce among the labouring classes of this country. To join the Army meant loss of liberty—a thing abhorrent to all classes of Englishmen. But loss of liberty was preferable to the slow starvation of unemployment and the rigours of an unenlightened Poor Law. So from the labouring population came the Redcoats who were to win at Inkerman in spite of the generals and who were to lose at Majuba because of them.

A study of the proportions given in Table I will confirm the nature of the social grade that provided the recruits.

TABLE I.—RECRUITS EXAMINED. ACTUALS BY TRADES

<i>Grade</i>	1860	1870	1880	1890	1900
Labourers and husbandmen	14,005	24,834	27,885	34,353	52,022
Artisans	10,908	10,301	13,616	15,231	23,172
Shopkeepers and clerks ..	2,541	2,486	3,079	3,535	5,950

It will be seen that the labourer and the artisan predominate. This is natural since not only were they the largest class but also they were the social groups most affected by adverse economic conditions. The artisan and town labourer were to feel the effect of a rising industrial competition from the continent while the agricultural labourer (husbandman of recruiting jargon) was to encounter depression with the Repeal of the Corn Laws and the opening up of the prairie wheat fields in Canada and U.S.A. Both groups were to feel the effects of the growing gulf between Capital and Labour which was only kept bridged with difficulty. The strikes and lock-outs of these formative years only serve to etch in sharp relief the poverty and conditions they sought to alleviate. By 1851 half the population of this country was living in towns and the sanitary conditions of these towns were deplorable. Throughout the 'forties little had been done to check the ravages of the jerrybuilder,

the rack renters of slum property or to remove the more glaring shortcomings of the labourer's environment. Cellar dwellings were common, the back-to-back houses—not to be forbidden until 1909—and airless courts were crammed with the men, women and children who were needed to tend the growing industries. Towns grew up to no settled or ordered plan. So did the children of such towns. Drainage, ventilation, water supplies and arrangements were alike neglected. Chadwick in his report of 1842 had compared the conditions in the towns with Howard's description of conditions in the prisons of Europe and he was not guilty of exaggeration when he said that they "... were exceeded in every wynd in Edinburgh and Glasgow inspected by Dr. Arnott and myself. More filth, more physical suffering and moral disorder than Howard describes are to be found among the cellar populations of the working people of Liverpool, Manchester or Leeds and in large proportions of the Metropolis." That was six years before the first Public Health Act. Ten years after it Simon was calling attention to the scandalously high death-rate in Lancashire and was showing that pulmonary tuberculosis was killing fifty thousand people in this country every year while another eight thousand were to die from scrofula and tabes mesenterica. At the same time the Army authorities were complaining that civilian conditions were the real reason underlying the fact that the phthisis death-rate of Soldiers of the Line was nearly equal to the civilian rate, while that of the Guards was considerably in excess of civilians of the same age-group. That the Royal Commission investigating the sanitary shortcomings of the Army did not accept this view but blamed Army conditions is beside the point since undoubtedly many undetected cases of tuberculosis must have slipped past the recruiting authorities to help produce this melancholy state of affairs.

Every year, as Simon indicated in his reports, "fever took its annual toll of seventeen or eighteen thousand victims" and, as he added significantly, "besides the thousands whom it kills there are as many times the number whom it prostrates for weeks and months, and whom, with their families, it impoverishes or perhaps ruins and pauperizes."

The infant mortality rate stood round about 150 per 1,000 live births and it was not until the beginning of the twentieth century that it began to decline. For the period 1901–1905 it had come down to 138 while between 1911–1915, the last five years of the period under consideration, it had declined still further to 108. The public conscience had been aroused as far back as 1843 by Charles Dickens in "Martin Chuzzlewit" with his sketches of Sairey Gamp and Betsy Prig, but it was not until 1902 that the first Midwives Act came on the Statute Book to protect the mother and the newborn child and it was not until the 'sixties that the Salford and Manchester Ladies' Committee laid the foundations of Infant Welfare. Simon pointed out that a high infant mortality rate meant that the survivors have been and will be exposed to dangers likely to impair their health over a very long period or even for all time. The infant mortality rate and the mortality from tuberculosis can both be regarded as an index of the sanitary well-being of a community. Both these indices showed that such a state of well-being was far from being the case in the

surroundings into which the raw material for the Army was born. It is small wonder then that the quality of the recruit was liable to be indifferent.

The worst conditions were found, as would be expected, in the rapidly growing towns. The rural population, although perhaps a little luckier over the matter of infectious disease, were little better off. Their dwellings, although picturesque, were often insanitary, damp and overcrowded. The natural spacing of the countryside, the cleansing winds and the absence of the pall of smoke which characterized the new towns contributed something towards the prevention of contagion. But poverty was never far separated from the peasant; hunger was no rarity to his crow-scaring offspring while "fever" from polluted wells and questionable water supplies was always ready to attack. The opportunities for augmenting income by cottage industry had dwindled to nothing. Unemployment grew as arable gave place to pasture in the face of the competition of the new world helped by relaxed Corn Laws. The drift to the towns began. Each addition to the towns further complicated the deplorable urban conditions. It was not until the 'seventies that the death-rate in our towns began to fall in response to improvements in housing and sanitation and even at the end of the nineteenth century the sanitary conditions of our towns left something to be desired. Although the standardized death-rate from tuberculosis had begun to decline it was still high enough to indicate that malnutrition, overcrowding and poor housing—the products of poverty—still remained. Cholera was a recurring threat until 1865 while deaths from "fever" showed no decline until the 'eighties when the great Public Health Act of 1875 began to pay its first dividends. The effects of the early factory legislation of the 'thirties and 'forties were slow in taking effect. Legislation regarding dusty trades and ventilation was a novelty in the 'sixties while the notification of certain industrial diseases had to wait until 1895. The idea of any medical control of adverse working conditions by systematic medical inspection was not to come until three years later. The raw material for the Army during this period therefore not only started life at a disadvantage but grew up under the handicaps imposed by poverty and poor environment while the conditions of work were equally detrimental. All through the period the population continued to increase: the population doubling itself between 1850 and 1911. As it increased so the social problems grew. From the main mass of society presenting these problems in their most concentrated form came the recruits. Undernourished; the stigma of their environment upon them; those who survived infancy to fail, through causes beyond their control, to find a livelihood presented themselves for examination at the recruiting centres to be rejected in numbers that each year could be measured in thousands. The rejection rates for this period are shown in Table II.

It will be observed from Table II that at each ten-year interval the number of recruits increased steadily until 1900. The marked increase in 1900 can of course be accounted for by the demand imposed by the South African war but between 1850 and 1890 there had been no major campaign although there was a good deal of colonial police and garrison work. To what then was this increase due? The strengthening of the Army to meet the rising power of

TABLE II

<i>Year</i>	<i>Examined</i>	<i>Rejected (actuals)</i>	<i>Rejections Ratio per 1,000</i>
1850	12,907	5,040	390.00
1860	27,853	7,128	256.00
1870	38,408	12,935	336.70
1880	46,108	18,794	407.61
1890	55,367	22,005	397.43
1900	84,402	23,000	295.00
1910	45,671	13,492	295.42
1913	42,977	8,703	202.50

Prussia—so obvious in 1870—may account for some of this but it is submitted that probably the major reason underlying the increase was the poverty which afflicted the labouring classes. A glance back to Table I will reveal that quite apart from an increased intake from the labourers and husbandmen during this period a similar increase was noticeable from the artisans and skilled labour; even the semi-educated shopkeepers and clerks showed the same trend.

The American Civil War had all but ruined Lancashire and there was great hardship and unemployment amongst the cotton operatives. The rising industrial potential of the Continent and countries like Japan with the increase in competition was being felt in English industry. It was inevitable that depression and unemployment should appear. The effects of these fell heaviest upon the labouring masses and, as has been stated earlier, poverty is one of the mainsprings of Army recruitment under a voluntary system. The somewhat inadequate picture that has so far been presented of the social background of the recruit has perhaps tended to overstress the economic background. Nevertheless, although there was a steady rise in the value of real wages during the nineteenth century, it was not evenly spread and poverty tends to dominate the scene. That much of this poverty was due to sickness and disability of environmental origin cannot be denied. Poverty produced sickness; sickness produced poverty; defects in sanitation, overcrowding and infectious disease and poor working conditions were integral components of this vicious circle which surrounded one section of the community. Ignorance, illiteracy and prejudice complicated the issues.

From Chadwick onwards there was a steady attack on these conditions and with the emergence of bacteriology to give reason and design to the efforts of the sanitary reformers conditions began to improve and be reflected in the vital statistics of the nation. From 1870 onwards Education began to be recognized as a social and national necessity rather than a matter of sectarian advantage or a field for philanthropic endeavour. With the rise of Education so the opportunities and scope for Health Education of the masses began to grow. Illiteracy had never been a bar to military service but soon the illiterate recruit composed only a small section of the total (Table III).

With the increase of education came the appreciation that the rising generation of children required attention and that their needs were all part of National Health. As is usual in this country local and voluntary efforts in this

TABLE III.—ILLITERACY PER 1,000 RECRUITS EXAMINED

Year	Unable to read or write	Able to read and write
1860	247	702
1870	186	709
1880	138	776
1890	41	850

direction long preceded central legislation for this purpose and the twentieth century was to be nearly ten years old before the School Health Service was officially born. So it was with tuberculosis. A beginning had been made to clean up the nation's milk supply and by 1890 the term scrofula ceased to appear in the causes for rejection of recruits. Robert Phillip was giving the lead in the attack on tuberculosis with his dispensary scheme in Scotland. In England the N.A.P.T. was, by voluntary effort, preparing the way for similar action in 1912.

Crosse and Torrens were supplying the machinery for local authorities to deal with overcrowding and slums but it was not until 1909 that the back-to-back houses were forbidden.

Throughout the period the recognition of specific hazards in factories and of the desirability of reasonable working hours grew along with the idea of the "selective" protection of certain groups of worker by inspection and certification. But all these were gradual processes. The evils and imperfections of living and working were too deep rooted for dramatic results. The activities of the reformers were inevitably directed upon the environment of the worker and to this day the working classes still present in some degree some of the problems of the nineteenth and early twentieth centuries. In spite of nearly sixty years of sustained Public Health effort the recruiting for the South African war was to reveal that the physical attributes of a certain proportion of the nation left something to be desired. Surgeon General Sir William Taylor suggested in 1903 that an enquiry into the conditions of the poorer section of the urban population from which was drawn the vast majority of recruits might be profitable. His suggestion cast a stone into a pool and the ripples have not yet died away. The Royal Colleges when asked to consider his views scarcely bothered to conceal their irritation at an Army medical man daring to tread the *via sacra* of civilian medicine, much less to impeach the Nation's Health!

The physicians, indeed, went so far as to suggest that as the death-rate had declined there was really no point in the Medical General's remarks. The surgeons, on the other hand, wrapped up their feelings more politely. While not agreeing that such an investigation was really necessary, they did suggest that perhaps stricter attention to the health, feeding and training of the school child, coupled with stricter regard for dental hygiene, might be a good idea. In spite of this lukewarm reception Sir William persisted in his views and the enquiry was launched in 1903 as "The Select Committee on Physical Deterioration." Its findings brought into sharp focus many of the deficiencies

that hedged around the environment of the poorer classes and its recommendations were clear, well balanced and in advance of the times. Many of them are bearing fruit today. It is however a reflection on the prevailing conditions of this period that such a committee should be considered necessary and that their recommendations should have included such a clear need for getting at the facts underlying such matters as the ownership of slum property, the causes and effects of over-fatigue, the adequacy of the treatment for syphilis and the care of young persons in mines, factories and workshops to mention but a few.

Into the ten years following this Committee were concentrated attacks on many long-standing evils. Maternal and infant mortality were to begin to fall. The social implications of tuberculosis and venereal disease were to be more closely appreciated. Above all, the idea of a national minimum of subsistence was to emerge along with the attack on poverty due to causes outside the workers' control. Against this background the recruit for the Army must be envisaged. An Army recruited from volunteers can never be fully selective in its material. If its material is drawn from the most depressed part of that section of society most subjected to environmental and social evils it must inevitably have a high rejection rate on physical grounds unless something is being done to remedy those evils.

Improvements which take place but slowly in the main mass will reach down last of all to those individuals whose motive for joining the Army is found to be purely in their need for the minimum necessities of life. That the type of recruit at the beginning of the twentieth century was still, in the eyes of the public, but little removed from the type who enlisted at the time of the first Public Health Act in 1848 is perhaps epitomized by Kipling.

"It's Tommy This and Tommy That and chuck him out the Brute ;
But it's ' The Saviour of his Country ' when the guns begin to shoot."

There was perhaps some justification on moral grounds for these sentiments but it is suggested that the men who were to turn and fight through the long and dusty days of Mons in 1914 represented human dividends on the capital outlay of Chadwick, Simon and their successors.

III

PHYSICAL STANDARDS IN VOGUE AND THE MAIN CAUSES OF REJECTION

Any attempt to assess the rejections of recruits on physical grounds in relation to Public Health progress must take into consideration the standards demanded by the Recruiting Authorities between 1848 and 1913. These standards are, inevitably, a reflection of the physical duties demanded of a soldier. These duties will change as the methods of warfare become altered by the advance and applications of science, with improvements in communication and the conception of National strategy. Apart from the Crimean and South African Wars the small professional Army of England was engaged in no major campaign of international significance between 1848 and 1913. In the former war the conception of a soldier's duties did not materially differ from those of the Napoleonic wars, particularly in regard to the staffing of

the administrative services ; while in S. Africa the idea that marching and fighting were not the only duties demanded of a soldier was just beginning to emerge. From this point on it began to be appreciated that men with some degree of physical disability could be fitted into the military machine and that there were degrees of physical demand at every level from the man who had to march and fight down to the man filling a clerical or sedentary task many hundreds of miles in the rear. Gradually the need for intelligence, skill and physical attributes came to be measured against the variety of military employments until today job analysis and personnel selection have been wedded to the physical findings at examination. Such a principle, however, is only evolved when the demands for man-power are all powerful and the size of an army is to be measured in terms of millions rather than thousands. It was not until the first World War that this principle was applied. During the period covered by this review the physical conception of a soldier's duties lay rigidly confined to the qualities essential for marching and fighting. It must be further appreciated that, until the Cardwell Reforms developed a system of Reservists, the recruit enlisted for an indefinite period and therefore conditions of physique which *might* conceivably as a result of service give rise to inefficiency and invaliding or serve as an excuse for the soldier to seek restoration of his liberty by medical means had to be excluded or else the recruit rejected. Such conditions as "laxity of the abdominal rings with a tendency to hernia" and "varicocele" are examples in point. These conceptions therefore undoubtedly influenced the rate of rejections for physical shortcomings. In general the standards in vogue were those which laid down minima of age, height, weight and chest measurement, although up to 1860 there was no indication of a minimum weight. In 1884 the minimum weight was given as 115 lb. The minimum age was 18 except for Boy enlistments while the height varied from a minimum of 5 ft. 4 in. for a driver up to 5 ft. 8 in. for a Heavy Dragoon. The Household troops set their own standards generally somewhat higher. Taken by and large the minimum height at which infantrymen were accepted was between 5 ft. 4 in. and 5 ft. 6 in., although in the year of stress induced by the South African War in 1900 the standard dropped to 5 ft. 3 in. No minimum chest measurement was specified before 1860 when a minimum of 33 in. was given except in the case of recruits for the Artillery whose minimum was fixed as high as 35 in. because the heavy work involved in manhandling pieces of ordnance was considered to require a greater vital capacity. In the earlier part of the period there was a loophole which permitted Regimental Surgeons to pass "growing lads" who, though below the arbitrary limits, were considered likely to fill out. These broadly were the basic standards required in the absence of any other disability and they were amplified in the Medical Regulations of the time which continued to stress the importance of systematic physical examination. The recruit was stripped and put through a variety of evolutions to test the integrity and mobility of his limbs. The heart and lungs were examined—the value of a careful stethoscopic examination was stressed. Visual standards were tested by the ability to count dots on a card and indicate their position. No other

standard was given until the introduction of Snellens Test Types early in the twentieth century.

Much importance was attached to such conditions as flat feet and varicose veins, varicocele and liability to hernia. The reasons for rejection on these grounds have been given above.

In general Medical Officers were "to be guided by their judgment and experience in choosing men possessed of the physical capacity requisite for the endurance of toil, hardships and exposures, as well as of sufficient intelligence." Quite early on the advantage of the country bred recruit over the town bred was appreciated and received official mention.

The causes for rejection on physical grounds numbered between thirty and forty. These were over and above those recruits rejected for **LOWNESS OF STATURE** for it was not until 1880 that "under height" was added to the official list of causes for rejection. Instructions were issued from time to time which were intended to guide the lay recruiting staff and to prevent them from bringing up the really poor material with more obvious defects before the Medical Officer. The bounties paid for recruits, however, did constitute an inducement to turn a blind eye to the physical shortcomings of recruits who might be "coached" through essential portions of the examination. It will be appreciated that while the Army could not draw on the best material it tried to maintain a standard based on the dual function of marching and fighting with the "hardship and endurance" clause thrown in. In the years of demand the standard would be relaxed. Nevertheless the causes for rejection and the rates for each are considered to give some guide to the quality of the material that presented itself and they can be matched against a physical standard that was more or less consistent for a particular section of the community. Fluctuations in the rejection rate may be due in part to the immediate manpower requirements, but they are also related to the general standard of health of the labouring classes.

In assessing this general standard of recruits and using it as a measure of Public Health progress it becomes essential to define from the causes of rejection given in the official returns those which can be considered to have their origin in environmental shortcomings and in the imperfections of living that beset the labouring class. That there were certain causes of rejection which contributed largely to the total rate has already been pointed out. These particular causes, e.g. flat feet, varicose veins, varicocele and tendency to hernia, cannot in all fairness be attributed to shortcomings in the environment of the recruit although there are perhaps some who would argue that the long hours and excessive standing in the factories during the earlier phase may have contributed to the first two of them. Nevertheless these conditions will not be considered. The causes for rejection therefore that will be extracted from the official list will be those that can be considered to have their origins in a background of poverty and ignorance; of overcrowding and infection; of poor housing and dampness; of dirty milk and malnutrition; of congenital disease and poor social hygiene; of long hours and poor and dangerous working conditions.

Such causes may be listed as follows :

- (1) Syphilis.
- (2) Scrofula.
- (3) Phthisis.
- (4) Impaired constitution and signs of unsound health.
- (5) Heart disease.
- (6) Small or malformed chest and curvature of the spine (from 1880 onwards this becomes "below minimum chest measurement").
- (7) Defects of the lower extremity due to fracture, contracture or luxation, etc.
- (8) Muscular tenuity ("underweight" from 1880 onwards).
- (9) Loss or decay of many teeth.
- (10) Defective vision.
- (11) Malformation of the chest and spine (as opposed to smallness and curvature).

It will be noted that all these conditions have in their origins one or more of the factors mentioned above. As these factors are remedied and minimized by social legislation and philanthropic efforts it is not unreasonable to expect a reflection of these efforts in a reduced incidence of rejection of recruits. As medical treatment and diagnosis also improve alongside the social conditions these should supplement such an improvement. The nomenclature of the causes of rejection changed slowly throughout the period. For example "muscular tenuity"—a broad term covering the modern idea of the "poor specimen" merged into "underweight" after 1880, while in 1913 valvular disease of the heart became separated off from "diseases of the heart" which had, up till then, covered all cardiac conditions. The term "impaired constitution and debility" gradually lost its additional qualification of "marks of cupping, leeching, blistering, etc." as medical practice became less empirical in outlook and less heroic in its methods.

Even up to the outbreak of World War I in 1914 no recruit was accepted who would require glasses and similarly there was no provision of dentures. As causes of rejection therefore visual and dental defects assume an undue importance. Nevertheless these conditions are considered of sociological importance—particularly the latter as they clearly demonstrate a shortcoming in social and personal hygiene that has continued to be a problem of this class of the community up until the present day.

Progress in Public Health cannot be marked off by definite intervals of time except in certain limited aspects. Its progress can be likened to the ebbing of the tide from a rocky foreshore. It is gradual, and although progress may not be obvious to the day tripper on the beach, soon vast areas of smooth sand are left between the rocks and the gain is clear. But the receding tide leaves pools among the rocks. As the tide of environmental shortcoming recedes it, too, leaves pools in its wake which require to be drained and filled if a smooth beach of Public Health is to be achieved.

It is the causes of rejection of the would-be soldier that represent these

pools in the health of the Labouring Classes and it is the legislative attack and social reforms in their environment that represent the draining and filling process. In the next section an attempt will be made to show that the tide of social and environmental defect ebbed steadily and that the pools it left grew smaller as social and medical advances drained and filled them.

IV

THE TRENDS IN THE RATES OF REJECTION ON PHYSICAL GROUNDS OF
RECRUITS. 1848-1913

The rejection rate on physical grounds for all causes per 1,000 recruits examined is shown in Table IV.

TABLE IV
Rejection rate per
Year 1,000 recruits examined

<i>Year</i>	<i>1,000 recruits examined</i>
1850	390.0
1860	256.0
1870	336.7
1880	407.6
1890	397.4
1900	295.0
1910	295.42
1913	202.5

This table shows that for all causes the rejections declined from 1850 onwards. The pronounced fall after the first ten years might, by the enthusiast, be taken to indicate that the First Public Health Act was making its presence felt. Perhaps it was. Although the rejection rate climbed for the next twenty years it rarely again attained the same peak. The progress was not dramatic anywhere in the country. The adoptive nature of the Act probably had something to do with this and, in addition, as the unpopularity of the Board of Health waxed so progress in Public Health waned and it was not to achieve its original momentum until the Acts of 1866 and 1875 saw the clear emergence of a local Sanitary Authority and the beginning of central powers in default. Nevertheless in the five years after the passing of the first Public Health Act a population of over two million in a variety of towns and populous places had begun to experience the advantages of safe water supplies, cleaner streets and improved sewerage. The sharp edge of the difficulties had been removed and ten years after the Act became law the recruit material was perhaps demonstrating the fact.

The great Public Health Act of 1875 and the growing powers of the Local Authorities aided by central persuasion and occasional coercion probably contributed to the improvement from 1890 onwards. It will be appreciated that many of the troubles which beset the labouring classes lay in their environment and the Act of 1875, sanitary in intent and in practice, codified the hitherto confused procedure to deal with purely environmental defects. The increased demands for troops in 1900 may probably have been instrumental in a relaxation of the approved physical standards but the fact remains that subse-

quent to this date an improvement in the physical state of the recruits did begin and the rejection rate in 1913 was reduced to just over half of what it had been in 1850. Civilian progress can be measured by the fact that a death-rate of 21·4 between 1870 and 1880 had dropped to 15·4 by 1910, while infant mortality had similarly declined from 149 to 128.

It is possible between the years 1860 and 1900 to show the rate of rejection of recruits drawn from the artisan class. After this year the Medical Department reports do not differentiate between the classes of recruits. Table V shows the rejection rates (all causes) for the major groups of skilled workers.

TABLE V

Year	<i>Manufacturing artisans</i> (<i>clothworkers, weavers, etc.</i>)	<i>Mechanics</i> (<i>carpenters, smiths, masons, etc.</i>)
	<i>rejections per 1,000</i>	<i>rejections per 1,000</i>
1860	267	274
1870	412	324
1880	443	431
1890	438	392
1900	290	260

It will be observed that, from 1880 onwards, the physical state of the artisan recruit began to show some improvement and was to some extent reflecting the improvement which was beginning to reach down to his class as a whole. Both the general death-rate and the infant mortality rate for the whole country were declining. Here again is some evidence, from a military source, that perhaps the Act of 1875 was getting into its stride. The rejection rates for the manufacturing artisans are, it is considered, a fair manifestation of where the public health shoe was pinching. The evils which surrounded the artisan recruit were deeply rooted and difficult of attack. The depression of the 'sixties had hit the textile industry hard and the jump in the rejection rate of recruits from this class between 1860 and 1870 is an indication of what poverty aided by a poor environment can effect in less than a generation and how difficult it is for legislation, however enlightened, to catch up with their defects.

It is of some interest to note that the recruiting district of GLASGOW—a rapidly growing industrial area—for the years 1860 and 1870 exceeded, in its rejection rate for recruits, the rate for the whole of the United Kingdom, while the newly formed district of MANCHESTER in 1870 even exceeded GLASGOW in the poverty of its human material. The opening of a recruiting district in MANCHESTER in 1870 was perhaps an example of how the Military Authorities tacitly appreciated the fact that unemployment and trade slumps contributed largely to their man-power. In 1880 Scotland, with Glasgow as its principal source of recruits, only provided some 3,200 men of a total of 46,000, but it had a rejection rate in excess of England. GLASGOW indeed did not seem to have altered much since the visit of Chadwick and Arnott forty years before. The figures quoted in this section give some idea of the overall rejection rates for all causes of recruits. Although they began to decline from 1880 onwards they really give little cause for satisfaction. That the decline, however, does give

some evidence of an improvement in the health of a particular section of the population is perhaps a note of consolation and is a reflection that legislation, humanitarian effort and philanthropic endeavour were perhaps beginning to yield interest.

The previous section outlined a list of the causes of rejection of the recruit which might be considered to have their origin in the environmental and social circumstances which surrounded his class. The object is to submit these causes to a more critical study and to see if it is possible to demonstrate from them some indication of improvement in the health of this class and to see if public health effort over the years has borne fruit. The conditions causing rejection will be dealt with separately and an attempt will be made to summarize the evidence from each.

(a) *Syphilis*

Table VI shows the rejection rate for syphilis per 1,000 recruits examined.

TABLE VI	
<i>Rejections for syphilis</i>	
<i>Year</i>	<i>per 1,000 recruits examined</i>
1850	10·00
1860	9·05
1870	14·42
1880	10·15
1890	6·29
1900	2·21
1910	1·40
1913	1·51

The decline in syphilis as a cause for rejection is quite distinctive from 1880 onwards. The causative organism was not demonstrated until 1905, but in spite of this the decline had been steady. With a lack of clear understanding of the underlying pathology it was probably inevitable that there were many congenital manifestations and that the recruit presented these in a wide variety. The tendency to provide insufficient or inadequate treatment based upon the disappearance of the primary lesion in the young adult probably accounted for a proportion of late secondary or early tertiary signs in the recruit. Ignorance, poverty and overcrowding were probably ætiological factors. Sufficient was known of the disease to appreciate that it was not worth while to accept a recruit with even a suspicion of syphilis. The diagnosis was made on entirely clinical grounds so the condition up to 1880 must have been extremely obvious. It is difficult to assign a specific cause for the decline in this cause of rejection and it is considered that it was probably due to a combination of many factors. Between 1860 and 1880 there had been a growing dissatisfaction with the operation of the Contagious Diseases Acts and this had led to a frequent and possibly franker consideration of the V.D. problem. The Acts themselves could have contributed little or nothing to the Health of the Community as a whole since they were applicable only to garrison towns but the discussion of their operation in relation to the total problem could do so. The growth of a

more scientific approach to medicine reinforced these discussions and probably began to bear fruit in earlier diagnosis, in the appreciation of marital infections and the significance of congenital manifestations. The attacks on overcrowding begun by Torrens and Crosse may also have assisted in the decline although it is doubtful if morals improved or promiscuity lessened because of this reason. The rise of Education from 1870 onwards, the medical activities of the School Boards and the beginning of interest in Infant Welfare may have contributed to a reduction in the clinical stigmata of congenital syphilis in the potential recruit. In the examination of the recruit the significance of the epitrochlear lymph nodes was probably given undue weight in the diagnosis of syphilis. Even nowadays in spare but healthy subjects these nodes may be palpable and sometimes an undue pathological significance is attached to them. How much more difficult then was the task of the medical examiner whose resources of observation had not the reinforcement of the laboratory.

The decline in rejections for syphilis of the recruit is a point in favour of a rising tide of social progress beginning to exert its favourable influence on a particular section of the community. It was not until the twentieth century that the infant mortality rate began to show a significant decline and although there were many more obvious factors at work it is considered that a reduction in the congenital manifestations of syphilis must have been a contributory cause.

The evidence from the figures for rejection of recruits is considered suggestive that Housing, Education and scientific advances were reaching down to the labouring classes and that an improvement in Public Health was being maintained throughout the period.

(b) *Scrofula and Phthisis*

The national death-rate from tuberculosis began to decline after the passing of the first Public Health Act. This decline coincided with the attack upon the environmental conditions prevailing in the towns. The infectious nature of tuberculosis had been appreciated as far back as 1856 by William Budd but his views were received with some suspicion even in the late 'sixties and the first real efforts at control—over and above the purely empirical attacks on sanitary evils—were not to begin until the 'eighties shortly after Robert Koch had discovered the tubercle bacillus. Scotland under Sir Robert Phillip led the way for England to follow early in the twentieth century. Royal Commissions and Select Committees began to draw attention to the dangers of milk. The peculiar English genius for antedating governmental effort by means of Voluntary Societies showed itself with the formation in 1898 of the National Association for the Prevention of Consumption and other forms of tuberculosis which focused the problem for all to see. Sanatorium practice spread to this country from Germany beginning in a small way at Ventnor in 1869 although the Sea Bathing Hospital at Margate as far back as 1791 had appreciated the problem of scrofula among the poor. Certain industrial towns tackled the problem by a system of voluntary notification. While all these imperfectly co-ordinated measures were still groping towards a universal system the

purely empirical sanitary reform was continuing. The sum total was that the population began to die from tuberculosis at a lower rate. That this decline in tuberculosis was a fact amongst the labouring classes is reflected in the improvement in the qualities of the recruits it provided who began to be rejected less frequently for scrofula and phthisis. Tables VIA and VIB give some standard of comparison.

TABLE VIA.—RECRUITS REJECTION
RATE

Year	Rejections per 1,000 recruits examined	
	Scrofula	Phthisis
1850	—	6.0
1860	12.08	2.26
1870	5.94	4.74
1880	3.62	4.79
1890	3.09	1.19
1900	—	0.98
1910	—	0.83

TABLE VIB.—CIVILIAN S.D.R.
Standardised tuberculosis
death-rate

Period	death-rate
1851-1860	3,478
1871-1880	2,882
1890-1900	2,021
1901-1910	1,646

Scrofula apparently became sufficiently infrequent after 1890 as to warrant its exclusion from the causes of rejection. Sunlight, fresh air and perhaps cleaner milk and a better standard of nutrition were becoming more general in the towns and coupled with a growing appreciation of the need for reducing the dangers of the open case in the overcrowded dwelling places of the poor produced the fall in the incidence and the rejection rates. The general improvement of the period is re-echoed by the improvement in quality of that portion of its menfolk volunteering for military service during this period.

(c) *Impaired Constitution and Debility*

Muscular Tenuity ("Underweight" from 1890 onwards)

These two causes for rejection of the recruit can conveniently be considered together in any assessment of Public Health progress since they are to some extent inter-related. Impaired constitution can be broadly interpreted as covering the recruit who was suffering from the effects of previous acute or debilitating illness or bearing the evidence of chronic ill-health of a type that could not be given a clear cut clinical label. In the earlier part of this period most illnesses, if prolonged beyond a few days, were productive of unemployment and distress with the inevitable result that full convalescence was impossible or that the labourer tended to carry on at work too long because he could not afford to be ill. Lack of adequate nutrition, the heroic remedies—cupping, leeching and blistering—the lack of fresh air and reasonable nursing probably contributed their share. Even allowing for Sir John Simon's strong Gallic sense of the dramatic his remarks about the effect of "fever" upon the poor, quoted earlier in this paper, contain a strong element of the truth.

Ignorance and poverty underly malnutrition and were probably the underlying factors in the second of these two causes for rejection, namely "muscular tenuity." This group includes the weedy and undersized and those who were

considered by the medical officers to be incapable of undergoing the rigours of military life although no organic disease was manifest. As might be expected from the sanitary and social circumstance of the labouring class these two causes for rejection bulked largely in the recruiting returns and are shown below in Tables VIIA and VIIB.

TABLE VIIA

<i>Year</i>	<i>Rejections for impaired constitution per 1,000 recruits</i>
1850	44.0
1860	30.47
1870	7.44
1880	11.88
1890	12.41
1900	4.94
1910	3.53
1913	3.86

TABLE VIIB

<i>Year</i>	<i>Rejections for muscular tenuity per 1,000 recruits</i>
1850	41.4
1860	27.15
1870	29.53
1880	28.20
*1890	44.09
1900	28.52
1910	5.34
1913	10.21

*UNDERWEIGHT from this date onwards.

The rejection rate for impaired constitution showed the more satisfactory decline of the two although there was improvement in each. As an index of the success of the attack upon the social evils of the period the rejection rate for the condition of impaired constitution is probably the better of the two. The death-rate for chronic disease like tuberculosis was falling; factory legislation to improve ventilation and reduce hazard from dusts and gases giving rise to chronic pulmonary conditions had made its appearance in 1864 and 1867. A system of notification for certain industrial diseases was introduced before the end of the century. Bacteriology appeared in the 'eighties.

The drive to improve conditions in the Poor Law Hospitals began in the 'sixties and the employment of trained nurses in the care of the sick poor began to spread after the daring experiment of Liverpool in employing Miss Agnes Jones. In London the M.A.B. was born. The process of recovery from disease was aided and with properly assisted recovery the residual effects of illness upon the poor were lessened. All these social improvements touched the labouring classes and are reflected in the falling rejection rate shown in Table VIIA.

The legislative provision of meals for necessitous school children at the beginning of the twentieth century, together with the earlier provision based on voluntary and philanthropic effort, probably contributed something to the reduction in "muscular tenuity" as a defect for rejection in the recruit. The pronounced increase in rejections for this cause in 1890 can probably be attributed to the fact that about this time the term "underweight" was substituted and, as the old idea of the "poor specimen" which underlay the term "muscular tenuity" was no longer practicable, a rigid adherence to the minimum standard of 115 lb. probably produced this result (see Table VIIB).

Study of the heights and weights of accepted recruits between 1860 and

1910 showed that the majority of them were about 5 ft. 5 in. to 5 ft. 6 in. in height and were between 120 and 130 lb. in weight. The average age of such recruits would lie between 18 and 19 years so they were well around the figures given in the modern tables of physical equivalents used in present day physical assessment (119-123 lb.). This, taken in conjunction with the falling rejection rate, might be taken as some evidence that fewer "poor specimens" were presenting themselves as the years went on. This decrease in those who failed to attain the minimum weight is in favour of an improving nutrition in this class. Perhaps the importation of cheap food under Free Trade Governments and the rise of the Co-operative movement contributed their share towards this improvement and to some extent went towards balancing the physical evils attendant upon the decline in the conditions of the agricultural labourer.

(d) Defects of the Lower Extremity due to Fracture, Contracture and Luxation

This cause of rejection does not include such defects of the lower limbs as *flat feet* or *varicose veins* which were a fertile source of rejection of the recruit. It is not considered, however, that these conditions can be directly attributed to environmental shortcomings whereas the effects of fracture, contracture and luxation have a considerable social and medical significance.

It must be remembered that, until the advent of LISTER in the 'sixties, and the rise of bacteriology in the 'eighties, the surgery of limbs, notably compound fractures, was a hazardous proceeding. If amputation was avoided the effects of sepsis on compound injuries of bones and joints invariably left their mark. Ankylosis would follow sepsis, delayed union and contractures would tend to occur. The absence of planned rehabilitation and the need for bold incisions would tend to result in crippling deformities or to leave the limbs with indifferent functional result.

Life in industry was hard and rough; accidents in factory, mine, quarry and workshop were common. Safety devices developed slowly and an injury in those early years, particularly the compound fracture or the fracture involving a joint frequently "went wrong." The lack of an adequate system of compensation or insurance to cover unemployment which might arise as the result of accident did not help recovery. The X-ray control of fractures—today an accepted part of normal routine—was in its infancy. Furthermore the young male in industry was a notoriously careless fellow, as indeed he still is, and it is only recently that his accident rate has dropped below that of his sister worker.

The figures therefore for rejection for this cause are interesting and it is considered that they reflect something of the progress that has been made not only by means of specific preventive legislation but also through the advances in medical science as applied to surgical practice. Table VIII gives the picture in the decline in the rejection rate for these defects. It will be observed that it was steady and maintained.

Apart from the advances in surgical technique that became increasingly general from Lister onwards the appointment in 1878 of a Chief Inspector of Factories gave added force to safety legislation. The power given to the

Secretary of State in 1891 to pass an opinion as to the dangers to life and limb inherent in certain processes and machinery must have given force and direction to the work of his inspectors in their task of improving the conditions for the worker. Furthermore, the attention to juvenile labour begun in the

TABLE VIII

*Rejection rate for
defects of lower extremity
due to fracture, contracture and luxation
per 1,000 recruits examined*

Year	
1850	55.0
1860	27.6
1870	19.7
1880	15.0
1890	16.7
1900	10.5
1910	18.7
1913	12.1

'thirties continued until the later years of the century were to see the emergence of the protected category of the "young person" whose welfare in industry was to be increasingly supervised. So as the industrial health of the labouring masses began to be improved so it came to be reflected in the quality of the military raw material they supplied.

(e) *Small or Malformed Chest and Curvature of the Spine. Malformations of the Chest and Spine*

These two conditions for rejection at first glance appear to be confusing or to cover much the same clinical conditions. They are of interest since both contributed largely to the rejection rate. It is considered that the first of them included a hotch potch of postural defects along with a poor range of chest expansion or a naturally small chest probably developmental in origin. The second of them included actual deformities due to chronic disease e.g. spinal caries or to nutritional shortcomings, e.g. rickets. In the 'seventies the "small or malformed chest" disappeared as a cause for rejection and its place was taken by rejection of the recruit for being "below chest measurement." So from this date onwards the rejection rate for each condition becomes a clearer guide to the physical state of the recruit. These rates are given in Table IX.

Column 2 demonstrates more satisfactorily the effects of the improvement in the conditions of life and living. The increasing care of the school child from 1890 onwards, when the London School Board set the example for others with their system of medical inspection and school meals, perhaps prevented some of the more obvious evils while the rise in the Infant Welfare Movement may have improved the nutrition and lowered the incidence of rickets in some areas. But the general decline in malformations of chest and spine as a cause for rejection does indicate that the standard of life of the raw material of the recruits was rising.

The large number of rejections (column 1) for inadequate chest measure-

TABLE IX		
Year	1	2
	<i>Rejection rate per 1,000 examined Small or malformed chest and curvature of spine</i>	<i>Malformation of chest and spine</i>
1850	37.0	Not known
1860	25.3	7.86
1870		26.70
1880	101.02	10.17
1890	101.45	9.75
1900	59.84	3.93
1910	43.97	6.04
1913	18.03	4.40

ment in the 'eighties may reflect the advantage found by medical officers in having a precise cause for rejection. Before this was available no doubt many rejections for inadequate chest measurement must have been placed under "muscular tenuity" or even shown as actual "malformation of the chest." It is considered that these large rejection rates in 1880 and 1890 merely reflect a change of emphasis but nevertheless the recruits of those years must have been comparatively poor specimens or else the minimum of 33 in. set too high a standard. In 1890 recruits were not only lacking in vital capacity but in that year they demonstrated quite noticeable shortcomings in height and weight, the rejection rates for these causes being higher then than for any other period. It is in this particular cause for rejection that doubts began to arise that perhaps all was not going well with the Public Health. This was confirmed to some extent by the high rejection rates of recruits during the latter years of the South African War. The national conscience was stirred by these revelations and the Committee on Physical Deterioration was, as has been previously shown, set up in 1903. This Committee showed among other things that the Army system tended to reject many men for defects that were no real bar to civilian usefulness and which were not incompatible with living to a healthy old age. This disclosure probably helped to sow the seeds of the idea of selective military employment within physical capacity.

The adolescent of England develops slowly, both physically and mentally. Subsequent experience was to develop the idea of permitting physical development of the sub-standard recruit within the Army. It would, however, be preferable if the imperfections of their life before recruitment were removed. Many of the recruits rejected between 1880 and 1890 would be accepted today and their development fostered in the Army.

Both these causes for rejection do show a steady decline but it is considered that a greater social significance can be attached to the decline shown in rejection for actual malformations (column 2). The improvement here is steady and maintained and is indicative of the increasing knowledge of the subject of nutrition, the value of sunshine and fresh air, the rising concern for infant welfare and for a less dubious milk supply. All these points would assist in the reduction of rickets, caries and similar diseases so productive of deformity.

(f) Defective Vision. Loss or Decay of Many Teeth

These causes for rejection of recruits are taken together for convenience and because they both demonstrate an unsatisfactory state of affairs in a particular social group. They are not grossly crippling or disabling in the civilian worker but both are productive of varying degrees of ill-health and represent an undesirable departure from the normal. In the recruit for the Army of this period they were definite handicaps. Good vision is an essential for marksmanship while sufficient sound teeth are an essential for the "hard tack" of campaign conditions. It will be remembered that neither spectacles nor dentures were permitted in the private man until the Great War was well into its stride and a new outlook about manpower had developed.

Visual causes for rejection included, until 1880 when diseases of the eye and eyelids were separated off, all aspects of eye-trouble from refractive error to inflammatory processes. In spite of this differentiation the rejection rate was not materially affected. In other words the inability to reach a required standard of *seeing* was common and the figures reveal a gap in the Public Health care of the labouring classes. As late as 1934 the annual report of the Chief Medical Officer of the Board of Education showed that 9 per cent of the children examined had some defects of vision. The equivalent population between 1848 and 1913 received little or no investigation until the establishment of the School Medical Service in the early part of the twentieth century. While the mere inspection of school children and prescription of the necessary optical aids would not tend to reduce the incidence of defective vision in recruits, such a procedure would at least reduce the loss of efficiency in the recruit-producing class as a whole and would prevent many of the tragedies that must have overtaken the myope or the child with ocular manifestations of congenital syphilis. This last condition, in the earlier portion of the period at all events, must have been a contributory cause to the rejection rate in the recruit.

Nevertheless these revelations by the recruiting authorities did have the result that the Committee on Physical Deterioration stressed the need for closer care of the school child.

The figures for the rejections for visual causes are given in Table X.

<i>Year</i>	<i>Rejections per 1,000 visual defects</i>
1850	29.0
1860	28.75
1870	38.50
*1880	44.94 (1.30)
1890	38.04 (1.90)
1900	36.42 (4.16)
1910	10.15 (1.84)
1913	21.5 (3.05)

*From 1880 onwards diseases of the eyes and eyelids were shown separately. The figures in parentheses show these rejections.

Although there was a decline over the last twenty years of the period the incidence of visual defects in young men is a cause for reflection on the prevailing standard of care of certain sections of the community. The loss of efficiency in a poorly lit industry or in the overcrowded workrooms must have been high. The education of the school child must have suffered and a considerable degree of social misery must have resulted. As an assessment of Public Health progress these figures are scarcely encouraging except that indirectly the data they provided did perhaps act as a catalyst for administrative remedial action. In view of the present demand for spectacles under the National Health Service Act such figures as the above might possibly have provided valuable data for the planning of provision.

Dental defects were summarized in the nomenclature of rejection as "loss or decay of many teeth." The figures given below indicate that the dental condition of the labouring classes was becoming progressively poorer.

Table XI shows the rejection rates.

<i>Year</i>	<i>Rejections per 1,000 dental causes</i>
1850	20.0
1860	9.52
1870	9.81
1880	6.46
1890	9.14
1900	20.02
1910	56.95
1913	21.97

The apparent improvement in the last three years of the period was due to instructions issued which permitted recruits to be accepted who were—after dental treatment by the Army—likely to possess "a sufficient number of sound teeth for efficient mastication." But the figures as a whole are a dismal reflection of the standard of personal hygiene and education which prevailed. It was only at the end of the period that a school dental service became available and although the young people of today are becoming more conscious of their teeth, there still exists a sad lack of dental hygiene among this section of the community and the school dental service, although considerably more developed, still falls short of requirements. Any direct evidence from these figures of progress is again lacking in this very essential aspect of Public Health although again an advance was made with the beginning of dental care in the school child.

(g) Heart Disease

It was not until after 1910 that valvular disease of the heart became a specific cause for rejection. Prior to this time the generic term "Diseases of the Heart" covered all cardiac causes for rejection of a recruit. In the first year that a differentiation was made valvular disease accounted for just under half of the total rejections for cardiac reasons. The rejection rate is shown in Table XII below.

TABLE XII

Rejections per 1,000 recruits

<i>Year</i>	<i>Diseases of the heart</i>	<i>Valvular disease of the heart</i>
1850	8.0	—
1860	12.8	—
1870	22.44	—
1880	21.82	—
1890	19.16	—
1900	13.15	—
1910	40.38	—
1913	28.5	12.89

Over and above congenital defects much of the origin of heart disease lies in the environment. Infections such as syphilis, rheumatism and streptococcal disease are probably major factors in its ætiology. Opportunities for all of them lay in the conditions which surrounded the labouring classes. Furthermore, malnutrition and anæmia can both contrive to produce effects which may simulate the physical signs of cardiac lesions. The exact significance of murmurs heard with the stethoscope was probably imperfectly appreciated during this period and undoubtedly many recruits must have been rejected on the sole grounds of the presence of a murmur. The systolic murmur at the base ; the arrhythmias of no significance ; the hæmic murmur of the malnourished and anæmic were all stethoscopic findings for which the underlying basis was not clearly understood. The Army Medical Department report for 1910 rather confirms this impression since no explanation for the increase in rejections for that year could be given other than " the stunted, anæmic and debilitated lad of poor physique (habituated to the excessive use of indifferent tobacco) and badly nourished, who has come forward for enlistment in towns, is a likely subject for such diseases." Three years later, however, valvular disease was separated off and the Army Medical Report for 1913 made mention of " harmless tachycardias " in " a nervous cigarette smoking recruit " while " fugitive murmurs, especially in the pulmonary area, of a purely functional character " were appreciated as not being uncommon amongst otherwise good recruit material. In other words, the wood was just beginning to emerge from the trees. Even if due allowance is made for errors due to these causes it does not appear that conditions were really improving. A *pro rata* application of the incidence of valvular disease as shown in 1913 to the consolidated figures of previous years still would show that just under half of the rejections were probably due to valvular disease. Social factors are considered to play an important part in promoting rheumatism and the incidence of this disease among the children of the poorer classes in industrial towns is more noticeable than in those of the well-to-do. Its incidence tends to increase with malnutrition, overcrowding and bad housing with the consequent opportunities for the spread of conditions like scarlet fever which may be one of the predisposing causes. The attack on these conditions, although begun in 1848, gathered momentum but slowly, but even today the problem of rheumatism remains formidable. If

we accept acute rheumatism as one of the major ætiological factors in producing these rejection rates then progress seems dubious. It is, however, considered that as the years went by the methods of actual ascertainment improved and the rising total indicated that the true state of affairs was being arrived at rather than there being an actual increase in the incidence of cardiac illness. As late as 1935 the Chief Medical Officer of the Board of Education was showing that 5 per 1,000 of L.C.C. children in average attendance demonstrated rheumatic symptoms and were admitted to hospital and of the total admissions some 18 per cent were probably incapacitated because of cardiac involvement. Such a system of ascertainment was not to be applied to the school child on a large scale until 1907 when the school health service was formed and there is no reason to suppose that the school population before this date were any less liable to rheumatism, the cardiac manifestations of which would, in certain instances, only be demonstrated for the first time at a recruiting examination.

V

SUMMARY AND CONCLUSIONS

(1) During the period 1848–1913 the recruits for the British Army were found from volunteers who came predominantly from the lower levels of the labouring class of this country. Such volunteers were examined as to fitness for service in accordance with physical standards that varied very little during the sixty-five years.

(2) The labouring class as a social group had suffered from the imperfections of living that had resulted from the misguided application of a rural and parochial system of social administration and sanitation to rapidly expanding urban communities. The physical and moral ills consequent upon environmental defects coupled with a material distress due to ill-understood economic forces had contrived to produce in the labouring class a public health problem which demanded solution. At first this demand was based on purely utilitarian grounds but, as the underlying causes of the problem became better understood, it became based on the grounds of humanity. This problem was inevitably reflected in the general physical standard of the recruit drawn from this particular class.

(3) As the social conscience of the country grew and the importance of national health became increasingly forced upon it so the improvement in the conditions of the labouring class proceeded and the sixty-five years of this period saw the evolution of a system of public health and social services.

As these services reached down to the main mass of the people and as they were extended in scope to embrace all aspects of its daily life from the rearing of its babies, the educational care of its children to the conditions under which it earned its daily bread, the improvement became manifest in the vital statistics of the nation as a whole and was reflected in that particular section of it that volunteered for the Army.

(4) A group of physical defects, considered to have their ætiology in the

upbringing and environment of the recruit have been selected from the causes of rejection given in official recruiting returns.

With certain exceptions the improvement in the national health is reflected in a steady decline in the rates of rejection for these defects.

This is considered to be evidence in favour of the fact that the effects of social legislation and humanitarian effort were reaching well down below the surface of the main mass since, generally speaking, it was the lower levels of the labouring class which provided the Army with its recruits.

(5) The notable exceptions to an otherwise general improvement were manifested by the rejection rates for visual defects, for dental defects and for heart disease. The lack of evidence in favour of public health progress that these rejection rates indicate is considered to be more apparent than real except in the case of rejections for dental causes.

It is considered that improved facilities of ascertainment are the main factors in this failure to decline rather than the occurrence of an increasing degree of visual and cardiac defect. There is some indication, however, that the administrative progress as far as the school child was concerned was not as general as it might have been during the period.

(6) The dental shortcomings are, however, considered to be indicative of a lack of public health progress in two ways. The inadequate education of this class as a whole on the need for sound dental hygiene was the first of these. The second was the inadequate provision to meet the inevitable demands that were made consequent upon improved ascertainment in a school population slowly beginning to come under public health control from 1870 onwards.

Admittedly dental shortcomings do not produce major inefficiency in civilian life but they do indicate an attitude of mind towards one aspect of social hygiene which is regrettable to say the least of it. The recruit for the Army was, in this defect, an indicator of the lack of social progress. Here again a study of the Army figures might have been some help in planning provision of dentures under the National Health Service Act.

(7) No doubt exists at all but that there was an improvement in the general public health at all levels in the population during the sixty-five years. The attempt to confirm this improvement by a study of one particular section of that population is perhaps not altogether convincing and perhaps the most that can be said is the fact of improvement in the nation as a whole is corroborated by a decline in the rejection of recruits for all types of physical defect from 1848 onwards.

It also serves to demonstrate that an Army, contrary to the generally held opinion, does not get the pick of the country's human material if it is recruited on a voluntary basis. The economic motives underlying the voluntary relinquishment of liberty entailed by enlistment are strongest amongst that level of society where economic strains are reflected in the environment and in the imperfections of living. Under such conditions an Army can merely take the best of what offers itself. In doing so its findings can reflect the effects of social amelioration.

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Clinical and Other Notes

CONGRESS ON HEALTH AND CONFERENCE ON TUBERCULOSIS

BY

"A. E. C."

It used to be said in certain circles that to be sent on a course was a well-deserved punishment for over-enthusiasm ! Be that as it may, there comes the time when seniority and senility combine to make it almost impossible to refresh one's mind in the manner of more favoured juniors.

Returning from abroad is now the introduction to a regulated period of leave during which the debilitated mind is meant, presumably, to recover and adjust itself to all those conditions of stress and difficulty on which information becomes so readily available to the newcomer. Personal experience in such matters as the evacuation and tactical disposal of dishes for washing up did much to keep the mind supple while re-registration of oneself and one's family and the necessary study of the explanatory pamphlets awakened the slumbering administrative sense.

The end of leave found one, therefore, forewarned and forearmed in all but the technical sense for the struggle ahead. It was a surprise and rapidly appreciated privilege to be sent as a delegate to the Health Congress of the Royal Sanitary Institute at Brighton. To many officers of the Corps the mention of the Institute will recall the Parkes Museum and certificates for Sanitary Inspectors. The programme of the annual congress of the Institute shows a much wider scope.

It was perhaps inevitable that recent legislative changes would receive prominence and so on the first day in the Section on Preventive Medicine Brigadier Glyn Hughes was to be heard opening a discussion on "The Hospital and Medical Services—a Review of the Present Situation and Desirable Developments." As a technical administrator he dealt with the early problems of specialist staffing, finance and estimates, buildings and maintenance as well as with the planning difficulties resulting from lack of time and the complexity of a region forming twenty-one general and seven mental hospital groups. Mr. Slessor, Chairman of the London Executive Council followed and spoke of the work of Executive Councils and the services (medical, pharmaceutical, dental, ophthalmic) which they controlled. He instanced as directions for development the supply and distribution of medical and other practitioners, the establishment of health centres and the building up of the specialist ophthalmic services. Apart from their general informative value, which was great, these

papers were of interest to a Service listener as indicating the present administrative set-up in the National Health Service.

In his Presidential Address to the Preventive Medicine Section, Professor Andrew Topping voiced a criticism of the emphasis of the National Health Service on curative medicine which left prevention, as he termed it, a poor hanger-on. He advocated health centres for improving the potentialities of general practice and for providing what he termed preventive clinics. He had something to say on the emoluments of the members of the preventive services in comparison with those of other branches of the profession. In regard to a new departure, he expressed the hope that the chest physicians of the future, who would replace tuberculosis officers, would have breadth of outlook and appreciation of the outstanding importance of environmental factors. In his closing remarks he expressed the view that if in ten years' time the demand for more hospital beds still existed, then the health services would have failed.

Sections dealing with Veterinary Hygiene and Town Planning were meeting on the same day and heard papers read on "The Public Health Aspect of Poultry Disease," "Farm buildings in relation to the health of dairy cows and milk production," "Some Aspects of Housing in a Metropolitan Borough" and on "Crawley New Town." The importance of the Health Visitor under modern conditions was emphasized at a conference when recent legislation affecting her work and conditions of training was discussed.

On the second full working day of the Congress the problem of divided interests arose because the Sections on Food and Nutrition and Hygiene in Industry were competing with Conferences of M.Os.H. and Engineers and Surveyors. A review of the printed papers suggested the M.Os.H. Conference as being likely to produce valuable discussion. The choice was a hard one as at the meeting on Hygiene in Industry, Mr. William Gissane was to speak on the work of the Birmingham Accident Factory and Dr. Maxwell Jones of Belmont Hospital, Sutton, on the problems of resettling the psychiatric patient.

In his Presidential Address Sir Allen Daley (M.O.H., L.C.C., and Chairman of Council Society of M.Os.H.) spoke of adaptation in the changing world in which we lived. He did not favour the transfer of local health services to national control as in the case of hospitals. Like Professor Topping he commented on the scope and remuneration of the M.O.H. whose job, as the Minister of Health had repeatedly stated, was to act as a link or bridge between the various services, and to ensure that they were all properly co-ordinated. In his closing remarks (after dealing amongst other subjects, with the necessity for health centres), Sir Allen referred to the opportunities which the new Act provided for the prevention of disease and the opportunities which the Congress gave for discussion of ways and means to that end.

On the same day the Food and Nutrition Section discussed fish and the fish industry and the Engineers and Surveyors "Basic Survey" and "Sewage Disposal Problems."

On the third day the Engineers met and discussed "Space Heating" and "Industrial Buildings and the Workers' Health" while the Sanitary Inspectors dealt with "Housing" and "Refuse Collection and Disposal." From a medical

point of view, the Section on Maternal and Child Health was of main interest. Professor Craig (Professor of Pædiatrics and Child Health, The University of Leeds) entitled his Presidential Address "The Inspiration of Home." He referred to the numbers of children sent to hospital for reasons arising out of the home or housing conditions. The challenge for the future was, he said, the promotion of child health *in* the home. The papers which followed dealt with the working of "The Children's Act 1948" and the "Nurseries and Child Minders Act 1948." The first Act became necessary with the end of the Poor Law and the second provides for registration and supervision. It was interesting to note that in Lancashire where conditions for children in the last century were notoriously bad, there is now no requirement for child minders while nurseries are in great demand.

The Section met again on the following day to discuss problems in the education of the physically handicapped child. The Sanitary Inspectors also had a second meeting when the subjects were "Supervision of Meat Production" and "Problems of Meat Inspection in a small Urban district."

This, the final day, presented a change in subject and geographical interest at the Section on Tropical Hygiene at which Professor P. A. Buxton gave his Presidential Address on "Control of Tse-Tse Flies by Human Settlement," an exposition which could not fail to impress, reasoned as it was with a breadth of view one would expect from a speaker of Professor Buxton's eminence and experience. Dr. Garnham (Reader in Parasitology of the University of London) followed and spoke on "Modern Concepts of Malaria Control." He had much to say on the power of the new insecticides and did not omit their difficulties and dangers. It was interesting to hear that he did not consider older methods rendered obsolete by the introduction of D.D.T. The session was concluded by a paper on "Tropical Ulcers; Theories in their Causation" read by Dr. Berry now of the Ministry of Health and formerly of the Colonial Medical Service.

It was some weeks before another opportunity arose to hear public health problems discussed by many experts from many angles.

The National Association for the Prevention of Tuberculosis held its second Commonwealth and Empire Health and Tuberculosis Conference from July 5-8, 1949, in the Central Hall, Westminster.

At the first meeting speakers from U.S.A., Canada, India, South Africa, New Zealand and Pakistan described the tuberculosis situation and problem as it affected their country. In the afternoon Dr. Geoffrey Marshall of Guy's dealt with streptomycin in a masterly summary of results and future possibilities. He was followed by Mr. Price Thomas of Westminster who spoke with forceful clarity on thoracic surgery, including the use of streptomycin. Speakers on other trends in modern treatment included Professor Lehmann of Gothenburg, Dr. Etienne Bernard of the University of Paris and Dr. Birath of Sweden who spoke on experience in the use of para-amino-salicylic acid. Dr. Scadding of London discussed the effects of streptomycin as a new and prolonged treatment on the demand for hospital beds. One result was that collapse therapy had become part of domiciliary treatment in suitable cases.

Administrative aspects were dealt with on one day, in the morning in a series of addresses on Regional, County and County Borough Tuberculosis Schemes and, in the afternoon, on Comprehensive Schemes for the Colonies. Sir William Jamieson spoke in the morning of the inadequate provision of the past, of the deep roots of the disease in environmental conditions and of the opportunity given by the introduction of the new Health Service. No change can come without some disadvantage and Councillor Hardman, Chairman of Wroughtington Hospital Management Committee, Lancashire, and Dr. Greenwood Wilson, M.O.H., City and Port of Cardiff, mourned for the past work of the Lancashire County Tuberculosis Service and the Welsh National Memorial Association respectively. Dr. Williamson of the Leeds Regional Hospital Board spoke of the measures taken to deal with the schism created by the National Health Service Act between the clinical and preventive aspects. The speakers from the Colonies left no doubt as to the size and seriousness of the problems in their respective areas.

Tuberculosis amongst students and nurses was the opening subject on the third day and was dealt with by Dr. Lundquist of Stockholm, Dr. Wherrett of Canada and Dr. Long of the University of Pennsylvania. Dr. Daniels of the M.R.C. in winding up, said that more knowledge and practice of elementary precautions was necessary in many hospitals. Masks were used in relatively few institutions and more attention was necessary to the detection and proper treatment of the early lesion. He cautioned that methods of maintaining resistance and avoiding hazardous exposure would not be rendered less necessary by the introduction of B.C.G. which did not provide complete protection.

The afternoon session on the third day marked a departure from usual practice in that the discussion of psychological and social re-adaptation in industry referred not only to tuberculosis but to chronic disease generally. The speakers were varied in approach. Dr. Chiesman, Medical Adviser to the Treasury, opened and was followed by Sir Frederick James, a director of Tata's, Mr. Dale of the Trades Union Congress, Miss Taylor-Davies, a medico-social worker, Dr. Bach, Physician to the Rheumatic Unit of St. Stephen's Hospital, London, Dr. Moorman of the Oklahoma State Medical Association, Dr. Davies, Chief Medical Officer of Boots' and Mr. Tallyn, Managing Director of Industrial Sections of Papworth.

This variety of speaker is perhaps the indication to the function and value of a Conference of this nature—the general and special impetus which comes from (or should it be to ?) a number of people of common interest and purpose who meet to hear and discuss. Annual conferences have been the object of some recent criticism and presumably there are good and not so good, and room for improvement. Subject matter apart, the standard of speaker and delegate and the efficiency of administrative arrangements would seem to have a considerable influence.

Attendance at the proceedings outlined above left the impression of audiences who retained their interest as well as their powers of free speech and criticism. It has been said that the informal discussions on these occasions are of great value and those undertaken and overheard left little doubt that this is

true. One delegate said he wanted to see as well as hear one of the speakers and he was perhaps expressing the desire of many of the "rank and file" to whom leaders and authorities often remain as mere names for years. Is it possible that by the seeing and hearing the community of purpose is much increased?

From a personal point of view both Congress and Conference provided a most valuable introduction for a stranger to general and specialized aspects of the working of the National Health Service Act. They also renewed some wartime friendships and showed that administrative problems are not infrequently of the same variety in civil and Army practice. Having been there before, the fact that the Health Congress was held at Brighton was immaterial to the writer.

Correspondence

SIR,

As an ex-P.O.W. in Japan, I have read with great interest the article by Major C. W. Maisey, *O.B.E.*, in the Journal for May, 1949.

He states "the story as to how . . . a life-line supply of medicines, food and other materials was maintained by a small body of civilians, must be taken for granted."

It would, nevertheless, be extremely interesting to hear how this was brought about, and how it was possible to obtain, for instance, 20 grammes sugar, 35 grammes meat, 5 grammes salt, and 5 grammes oil, as a daily average, not to mention eggs, which were apparently sufficiently numerous to allow of "salting down," nor such adjuvants to treatment as thiamin, nicotinic acid, red palm oil, riboflavin, cod-liver oil, fresh liver, etc.

The diet in the camp I was in consisted of rice—700 grammes for men working in the coal mines, 570 for "indoor workers and sick, 390 for officers whether they worked or not, and a vegetable soup, made of much the same vegetables as mentioned by Major Maisey. On rare occasions small quantities of meat, allowing approximately $\frac{1}{2}$ oz. per man were added, and rather more frequently fish, occasionally mackerel, more often squid, cockles, or some unknown variety of whitefish which was mostly bones. Seaweed was also delivered comparatively frequently.

About twice a week the rice was replaced by "buns," made of unleavened flour, and steamed, as there was no oven in which to bake.

For the last eighteen months there was no meat, and for the last year no fish.

Eggs, milk, sugar, fats were unknown, except the three last when Red Cross parcels arrived, which on the average was one per man per half-year.

Some of us supplemented our proteins by eating dogs, cats, snakes, rats, and frogs, whenever we could get them. One enterprising R.A.M.C. sergeant bred cats for the table.

Although there was officially a canteen no foodstuffs were available for sale.

Incidentally, I feel sure there is a misprint on page 256, where the R.B.C. count of a patient is given as 500,000 per c.c.

Furthermore, is it really possible that 10 kilos of flies per day for fourteen days were killed by swatting? An average sized fly weighs about 10 mgm., so 10 kilos would represent about a million flies. As the hospital held 700 patients plus 100 staff, and it is reasonable to suppose that perhaps 50 per cent were not capable of taking part, this gives an average of 2,500 flies per man—not bad going for half an hour's work!

The author must be congratulated on the ingenuity and perseverance with which he and his staff improvised so many things essential in a hospital.

I am, etc.,

H. G. ROBERTSON,
Lieutenant-Colonel, R.A.M.C.

CORRECTION

ON page 162 reference is made to "the Colonel-in-Chief of the Q.A.R.A.N.C." this should be "Commandant-in-Chief"; also "Colonel Commandant" should read "Controller Commandant." Matron-in-Chief's correct designation should be "Senior Controller Anne Thomson, C.B.E., R.R.C., K.H.N.S."

Reviews

STUDIES IN AIR HYGIENE—MEDICAL RESEARCH COUNCIL SPECIAL REPORT
SERIES NO. 262. By Bourdillon *et al.* London: His Majesty's Stationery
Office. 1948. Price 7s. 6d.

This report records the work of a group led by Dr. Bourdillon. In the words of the preface it "must be accepted as a landmark in the study of air hygiene; for not only have various practical methods of air disinfection been assessed but the one fundamental prerequisite to any satisfactory work on the subject—a reliable and easy technique for the quantitative estimation of the bacterial contamination of air—has been attained."

Subject matter falls into four main groups. The first describes the various instruments used for sampling air, the second is concerned with practical methods of air disinfection, the third with field studies and the last with animal experiments.

A useful summary by Dr. Bourdillon of the practical advantages of different methods of air disinfection is also included.

A. E. C.

THE STORY OF SCABIES. By Reuben Friedman, M.D. Volume I. New York : Froben Press Inc. 1947. Pp. 452. Price \$7.50.

Dr. Friedman gathers together much of his previous writing on Scabies in this the first of three volumes. The prevalence of the disease, military and civil, its prevention, biology and treatment up to the beginning of World War II are exhaustively dealt with.

The work of MacCormac, Small and Munro in World War I is referred to and Mellanby's experiments on transmission are quoted as a contrary opinion at the end of the Section on Prevention. The Section on Biology is beautifully illustrated and paper and binding are of excellent quality.

A valuable work of historical reference.

A. E. C.

DEMONSTRATION OF PHYSICAL SIGNS IN CLINICAL SURGERY. Second Edition. Parts 1, 2, 3 and 4. By Hamilton Bailey. Published by John Wright & Sons. Price 8s. 6d. per part.

This book remains unique, in spite of its appearance in a new edition in paper covers and four volumes, for reasons given in the preface. If there were any other such book, it would still be second to none and should be in the possession of all surgeons, housemen and students.

A.-G. D. W.

NOTES FROM A.M.D.

THE D.G.A.M.S. inspected No. 17 Field Ambulance (Officer Commanding Lt.-Col. J. D. P. Macpherson, *O.B.E.*, R.A.M.C.) at Leipzig Barracks, Crookham, on June 11, 1949, preparatory to its departure for Hong Kong.

The unit was drawn up by companies in line for inspection and after the inspection marched past the saluting base in close columns of platoons.

The D.G.A.M.S. also inspected at the Royal Victoria Hospital, Netley, No. 33 General Hospital, No. 20 and No. 21 Field Surgical Teams and No. 8 Field Transfusion Team on August 5 before their departure for Hong Kong.

The Officer Commanding (Lt.-Col. J. Macfarlane, R.A.M.C.) was in charge of the parade.

After the inspection the units marched past to music provided by the Corps Band.

The Director-General addressing the troops afterwards on these parades complimented them on the smartness of their appearance and turnout. He said that the prospect of active service was a stimulating one, which they would all look forward to. They were going to a part of the world which was full of interest and excitement. They must remember that as British troops they had a time-honoured tradition to uphold, and that as soldiers in the R.A.M.C. they must remember and carry on the high standards which we had always set. He finally wished them God-speed, good luck and safe return.

Extracts from the London Gazette

LIST 1.

(1) HONOURS AND AWARDS

(a) R.A.M.C.

- (i) The King has been pleased to grant unrestricted permission for the wearing of the following decorations which have been conferred on the undermentioned personnel in recognition of distinguished services in the cause of the Allies :

Decorations conferred by His Royal Highness The Prince Regent of Belgium.

Croix de Guerre 1940 with Palm

No. 7522578 W.O.I. Richard Vincent Johnson, R.A.M.C.
 No. 7373801 S/Sergt. Albert Jones, R.A.M.C.
 No. 7381496 Sergt. Leonard Floyd, R.A.M.C.
 No. 7356809 Cpl. Robert Palin Bennett, R.A.M.C.
 No. 7394918 Pte. Leonard Boyes, R.A.M.C.
 No. 14303952 Pte. Norman Daley, R.A.M.C.
 No. 7404801 Pte. Clifford Newbold, R.A.M.C.
 No. 7401840 Pte. William Scoular, R.A.M.C.

Errata L.G. dated 19 Nov. 1948.

- (ii) The King has been pleased to grant unrestricted permission for the wearing of the following decoration which has been conferred on the undermentioned officer in recognition of distinguished services in the cause of the Allies :

Decoration conferred by His Majesty The King of The Hellenes.

Commander of the Royal Order of the Phoenix

For : Captain Arthur Malin Boyd, M.B. (135475),
 Read : Lieutenant-Colonel (temporary) Alexander Michael Boyd, M.B.,
 F.R.C.S. (161401), Royal Army Medical Corps.

(b) R.A.M.C. (T.A.)

The King has been graciously pleased to confer " The Efficiency Decoration " upon the following officers of the Territorial Army :

Maj. (A/Col.) R. W. Nevin
 Maj. T. MacGregor-Gibson

(2) PROMOTIONS

(a) R.A.M.C.

(i) Captains to be Majors :

Capt. (WS.Maj.) T. W. Carrick, M.B.	26.10.48
Capt. I. A. Walsh, M.B.	31.1.48

(ii) Short Serv. Commns. to be Capts.:

WS. Capt. I. M. Grant, M.B.	28.7.45
Lt. L. F. W. Rowe, M.B.	20.6.49

(b) Q.A.R.A.N.C.

S. Comd. O. E. Clarke, <i>R.R.C.</i> to be C. Comd.	20.5.49
J. Comd. D. O. Wakeham, <i>A.R.R.C.</i> to be S. Comd.	20.5.49
S. Comd. G. E. Morgan, <i>R.R.C.</i> to be S. Comd.	27.6.49
J. Comd. E. J. Stirling to be S. Comd.	26.6.49
J. Comd. M. L. Hallows, <i>R.R.C.</i> to be S. Comd.	27.6.49

(3) APPOINTMENTS TO PERMANENT AND SHORT SERVICE COMMISSIONS

(a) R.A.M.C.

- (i) From Short Serv. Commn., to be Capt.:

Capt. H. R. Vincent (retaining present seniority)	13.5.49
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- (ii) From Short Serv. (Specialist) Commns., to be Majs.:

Maj. W. F. Hooton (retaining present seniority)	21.6.49
Maj. R. M. Henderson, M.B. (retaining present seniority)	21.6.49
Maj. J. C. Scott (retaining present seniority)	21.6.49
- (iii) From Short Serv. (Specialist) Commns., to be Cpts.:

Capt. J. K. Sugden (retaining present seniority)	21.6.49
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- (iv) From Short Serv. Commns., to be Cpts., 21.6.49, (retaining present seniority):

D. C. Dougherty	W. S. Millar	
R. Fuller	J. F. Pearce	
R. O. J. Fry	D. H. Provan	
A. A. Gregory-Dean, M.D.	J. F. F. Rooney	
J. F. L. Lyons, M.B.	A. H. B. Rydon	
D. E. Marmion		
- (v) From T.A., to be Lt.:

WS. Capt. I. M. Grant, M.B.	28.7.45
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- (vi) From National Service List to be Lt.:

Lt. J. P. Crowdy, M.B.	24.6.49
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(4) RETIREMENTS

(a) R.A.M.C. and late R.A.M.C.

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|---|----------------------|
| Col. F. McKibbin, <i>O.B.E.</i> , M.B. | 1.7.49 |
| Lt.-Col. J. F. Shepherd, <i>M.B.E.</i> , M.B., F.R.C.S. | 30.6.49 (Hon. Col.) |
| Lt.-Col. J. M. MacKenzie, <i>C.B.E.</i> , M.C. | 23.7.49 (Hon. Brig.) |
| Maj. H. Jacques, <i>M.C.</i> (Temp. Commn.) | 29.6.49 |
| Col. W. D. Anderton, <i>M.C.</i> , M.B. | 26.7.49 (Hon. Brig.) |
| Maj. J. Walsh, M.B. (disability) | 13.6.49 |

(b) Q.A.R.A.N.C.

- | | |
|--|-------------------------|
| J. Comd. K. B. Davies, <i>M.B.E.</i> , <i>R.R.C.</i> | 15.7.49 (Hon. C. Comd.) |
| J. Comd. D. Sinden (disability) | 11.7.49 (Hon. S. Comd.) |

(5) HALF-PAY

R.A.D.C.

Lt.-Col. W. G. Martin is placed on half-pay on account of disability 7.7.49

LIST 2.

(1) HONOURS AND AWARDS

R.A.M.C.(T.A.)

The King has been graciously pleased to confer "The Efficiency Decoration" upon the following officers of the Territorial Army:

- Maj. (A/Lt.-Col.) C. K. Sconce
- Maj. J. M. Lees

(2) PROMOTIONS

(a) R.A.M.C.

- (i) Captain (QM.) to be Major (QM.):

S. P. J. Brown	18.8.49
----------------	---------

(ii) Short Serv. Commns., to be Cpts.:

Lt. D. J. Cowan, M.B.	1.8.49
Lt. J. R. Watson	1.8.49

(iii) *Amendment*

The date of promotion of Maj. A. C. Cox, *O.B.E.*, M.B., to Lt.-Col. is 30th May, 1949 and not 22nd May, 1949, as notified in *Gazette* (Supplement) dated 17th June, 1949.

(b) R.A.D.C.

(i) Majs. to be Lt.-Cols.:

Maj. K. H. Coulton	7.7.49
--------------------	--------

(ii) Short Serv. Commns., to be Cpts.:

Lt. L. K. Walden, B.D.S.	10.8.49
--------------------------	---------

(3) RETIREMENTS

(a) R.A.M.C.

Lt.-Col. R. D. Davy, <i>O.B.E.</i> , <i>M.C.</i> , M.B.	7.8.49 (Hon. Colonel)
Col. A. C. Jebb, M.B.	12.8.49
Major R. T. Fletcher, <i>M.B.E.</i> , M.D.	29.7.49
Major H. A. Ferrante, M.D. (S.S.C.)	16.8.49
Capt. E. R. Cole (S.S.C.)	16.8.49 (Hon. Major)
Capt. D. Macdonald, M.B. (S.S.C.)	16.8.49 (Hon. Major)
Major R. H. Smythe (S.S.C.)	16.8.49

(b) R.A.D.C.

Lt.-Col. W. G. Martin (disability)	7.7.49
(In substitution of notifi. in <i>Gazette</i> (Supp.) dated 8.7.49.)	

(4) APPOINTMENTS TO PERMANENT AND SHORT SERVICE COMMISSIONS

R.A.M.C.

(a) From Emerg. Commn. to be Capt. S.S.C. (A. & T.):

Capt. (QM.) Earl Taylor (sen. 17.3.45)	1.4.49
--	--------

(b) From Short Serv. (Specialist) Commn. to be Maj.:

Major R. T. Wordingham	21.6.49 (retaining present seniority)
Major J. B. Harrower, M.B.	21.6.49 (retaining present seniority)

October, 1949.

No. 4.

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Journal

OF

THE

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Journal of the Royal Army Medical Corps.

Original Communications

THE WEBSTER OPERATION FOR GYNÆCOMASTIA

BY

PATRICK CLARKSON

*Surgeon in Charge, Plastic Centre, St. Charles Hospital. Plastic Surgeon,
Basingstoke Plastic Centre and Royal Northern Hospital. Casualty Surgeon,
Guy's Hospital*

SERVICE surgeons are possibly more likely to see cases of gynæcomastia for whom surgery must be considered than their civilian colleagues. Thus Commander George V. Webster [1] reports that, although gynæcomastia was an indication for rejection at induction examinations, there was an incidence of 6.96 to 9.46 per 100,000 of the condition amongst those in the U.S. Navy between 1939-1942. The incidence of the condition in the Services is not due to the effect of webbing or uniform, which is negligible in the aetiology of the condition. It arises from the more frequent medical inspections at the most common age for the condition, from its more frequent recognition in the communal life of the Services, and to the desire of the patients on this account to have something done for the correction of the female appearance of their breasts.

The reaction of the typical patient to his condition has been graphically described by W. Gordon Gill [2], writing of an ordinary seaman in the Royal Navy who suffered from gynæcomastia, and quoted by Commander Webster [1]: "... The most striking thing about the patient was his extreme reticence to expose himself as other men do in the tropics. He had never been known to remove his shirt in public if he could avoid it, dreaded having a bath in company with his mates, and would never sunbathe or bathe in the sea. His life was being made miserable by his complaint and the ragging of his messmates did not help to improve his mental make-up. He was depressed, retired and reserved, and even in the hospital he always retained his shirt. Before joining the Service, for hostilities only, he had taken little notice of his condition, but

the somewhat natural ragging to which he had been subjected, had rapidly changed his character, and he was extremely keen to rid himself of his deformity."

There are additional reasons for recommending the removal of an enlarged breast in the male—these are the increased liability to trauma of the breast under Service conditions, and the possibility that such breasts may be more prone to malignant changes.

According to Dr. Jerome P. Webster [3] the pathology of the condition is fairly consistent. The abnormal mass is comprised: either of periduct connective tissue, which hypertrophies and forms a firm white mass localized to the subareolar region; or there is an increase in both the periductal tissue and adipose tissue; or thirdly there is adipose tissue hypertrophy alone. It is this last group of patients, in whom the size of the breast is due entirely to excessive adipose tissue, that show general evidence of glandular dysfunction and insufficiency, such as Frohlich's syndrome.

Paulus Aegineta [4], 625-690 A.D. (quoted by Dr. Jerome P. Webster) [3],

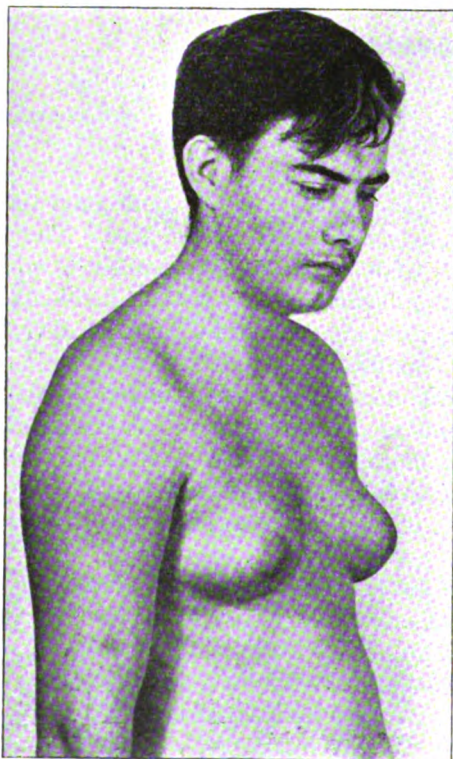


FIG. 1 (*Case 1*).—Intersex type treated by androgen implant (Dr. P. M. F. Bishop), and then willing to have breasts removed.

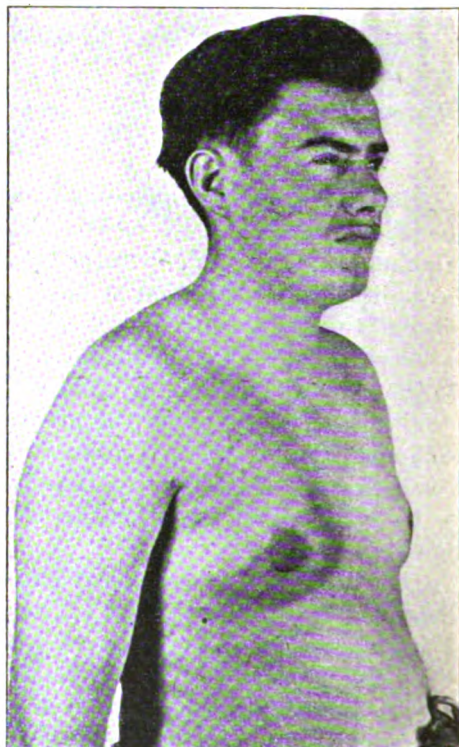


FIG. 2 (*Case 1*).—Post-operative result at fourteen days. The excessive skin has not completely settled in, but the breast protuberance is within normal limits for his physical type and stature.

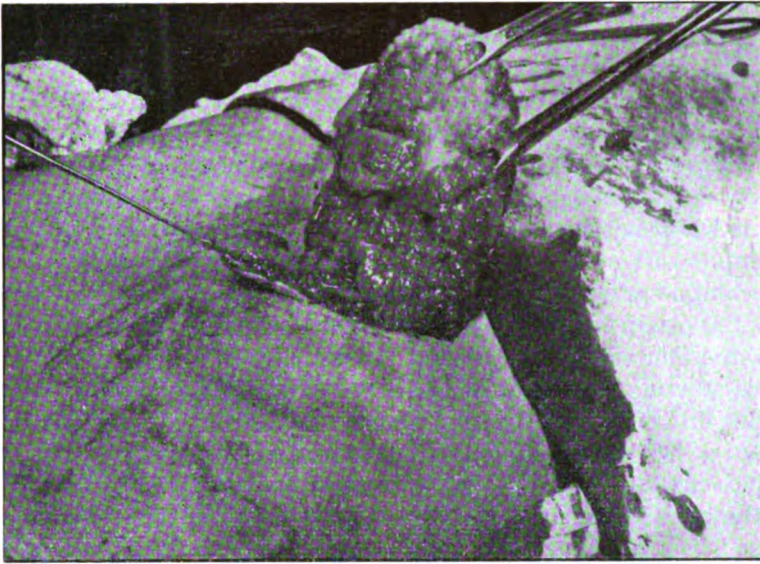


FIG. 3 (*Case 1*).—Operative technique. This picture illustrates the trap-door flap formed by the intra-areolar incision, and the extensive amounts of breast tissue which can be removed through it.

first described the condition and advocated "... removal of the excess tissue through a single submammary lunar incision or, in marked cases, through two lunar incisions coming together at the ends and with the excision of the subtended skin." All operations described since that date, and there have been many, leave long oblique or semicircular scars across the front of each side of the chest. The nipples are often removed. The site and direction of the scars make some degree of hypertrophy and broadening certain. The end appearance is a chest which, while flat enough, has additions and subtractions to normal male appearance sufficiently obvious to attract the attention and comment in communal life which it was one of the objects of the operation to avoid.

In 1945 my attention was drawn to an alternative operation by Dr. Jerome Webster [3], Consultant in Plastic Surgery to the U.S. Army, who showed me in his outpatients at the Presbyterian Hospital, New York, a case which had been treated by his method. The nipples remained in their normal position, the circumareolar scars were quite unnoticeable, indeed nearly invisible even to close inspection.

TECHNIQUE

The technique described here is based on that described by Dr. Jerome P. Webster [4] in "Mastectomy of Gynecomastia through a Semicircular Intra-Areolar Incision," but varies in detail.

The incision is made around the lower half of each areola ; or it may be

placed around the lateral quadrants if the major mass of the breast enlargement lies laterally. It takes advantage of the fact that incision placed near a junction between pigmented and non-pigmented areas nearly always leave quite unnoticeable scars, and of the fact that intra-areolar scars heal with much less hypertrophy than those in breast skin. The wound is deepened vertically for about 1 cm. and then the whole of the nipple undermined as a trapdoor flap from below up at this depth. Unless a layer of subcutaneous tissue and breast like this is left beneath the nipple it will later form a depressed adherent patch which dimples with each respiration. Cutting the flap to this depth is a variation in the technique described by Dr. Jerome Webster. He takes a trapdoor flap of areola, but places great insistence on suturing under it a layer of subcutaneous tissue from either side at the time of closure.

Beyond the nipple the dissection is taken at an increasingly deeper plane, keeping superficial to the breast parenchyma. At the breast periphery the dissection reaches the muscles of the chest wall. Lane tissue forceps are placed at the apex of the core of the breast tissue so defined. By traction the nearest part of the circumference of the breast is brought into view and undermined to expose the retromammary layer between breast and pectoralis major. Dissection in this plane then frees the breast tissue in one mass. A very considerable mass may be manipulated through the small trapdoor exposure. Dr. Jerome Webster points out that if the mass is too bulky it may be divided in order to remove it through the areola aperture.

Hæmostasis is secured by dry gauze pressure for five minutes, by diathermy coagulation, and by patience. The wound is closed in two layers by catgut and interrupted fine silks. Post-operatively pressure is obtained by circular elasto-plast and firmly applied dry gauze packs. It is maintained for ten days.

Reduction in Size of Areola.—Many of these cases have not only protuberance of the breast but grossly enlarged areolæ. The reduction of these areolæ to the normal size may conveniently be combined with removal of the breast tissue. The incision employed in these cases is in the form of that which is used for the reduction of a bulky female breast, but lies entirely within the areola.

RESULTS

I have treated 5 cases using this operation.

They have included 2 extreme cases (Cases 1 and 2). The amount of breast tissue on each side being of some 228 grammes in Case 1, and 203 and 190 grammes in Case 2.

Case 1 belongs to the group with generalized endocrine insufficiency. He was a boy of inter-sex type who had long refused to have any operative reduction of his breasts. He had, however, on one occasion consented to an androgen implant into the rectus (by Dr. P. M. F. Bishop, by whom the case was referred). Some months after this he ceased to prize his female form and consented to the removal of the breasts.

Case 2 was a different type. He had entirely natural male instincts and



FIG. 4 (*Case 2*).—Pre-operative photo. Normal male sex characteristics and marked embarrassment on account of shape and size of breasts.

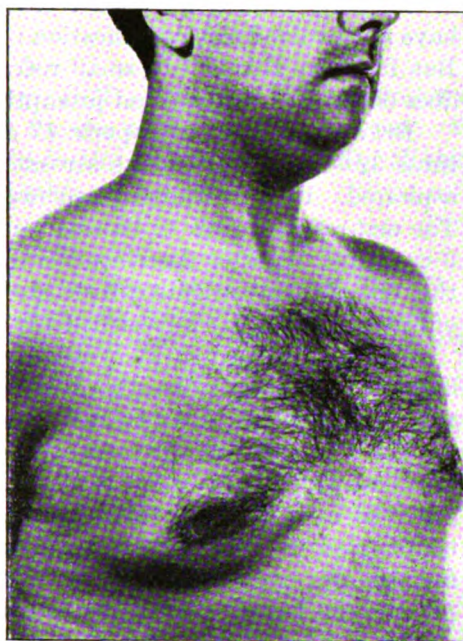


FIG. 5 (*Case 2*).—Post-operative photo. This shows that excess skin remains, but his chest contour is in true normal limits for a fat male. He is completely relieved of his sense of embarrassment.

sex life, and had been continually embarrassed by his enlarged breasts. When discussing them he showed the typical reaction of resentment and taciturnity.

In one of these 5 cases there were hæmatomata on each side when he was seen two weeks after operation. He had been allowed home four days after operation wearing firm circular elastoplast compression. This was removed after a few days at home because of the hot weather. The hæmatomata did not reappear after aspiration; the wounds healed by first intention; and the end-result was a good one.

Primary healing occurred in all cases. The end-result in all 5 cases (and ten breasts) has been a normal male contour with nipples in the proper position of normal size and mobility.

DISCUSSION

The non-operative treatments of gynæcomastia are endocrine therapy, and X-ray. The literature concerning these treatments is reviewed by Webster [3]. He concludes that they offer little chance of improvement.

It should be noted that the effect on the breasts of a patient with gynæcomastia of a general loss of weight by diet is the same as in the female—the breasts become more pendulous rather than flatter.

The chief objection to the Webster operation is the risk of hæmatoma. I have not avoided this complication ; it occurred in one case as detailed above. But I believe that it is a small risk if proper care is taken. If a hæmatoma does occur it should respond promptly to simple measures.

Dr. Jerome Webster reports 17 cases of whom 15 were bilateral. In 5 of these 32 breasts there was a serosanguineous fluid collection which had to be aspirated. Four of the nipples showed patchy necrosis and delay in healing. The end-results in all 32 breasts were almost uniformly satisfactory ; but in 3 cases Dr. Webster describes the reduction as short of complete, and states that one of these patients still refuses to undress in public. The greatest amount of breast tissue removed weighed 450 grammes, and measured 14 by 13 by 4 cm.

Commander George V. Webster, U.S. Navy, at one time Resident to Dr. Jerome Webster at the Presbyterian Hospital, describes the value of the method in the U.S. Navy [1], but does not add details of results.

The redistribution of the excess skin after removal of the breast tissue over the chest wall readily occurs in most cases. Where a lot of breast tissue has been removed care must be taken to see that the lax skin is evenly and firmly compressed over the operation site, and that this pressure is maintained for a fourteen-day period to avoid folds and wrinkles. Cases 1 and 2 possibly represent the largest development of the breast in which a satisfactory result can be obtained by this method, without excision of some of the excess skin. Such an excision would probably best be planned to leave a vertical scar 2 in. by 4 in. running down from the nipple.

The microscopic picture in 3 of the cases without evidence of general endocrine dysfunction does not entirely conform to that described by Webster [3]. In all these cases including those breasts of 203 and 190 grammes, the major part of the tumour was an excess of interstitial fibrous tissue. There was very little fat. All cases showed evidence of secretory activity in the ducts. In one case the ducts were flat, and pale, and dilated.

The duct epithelium in the two others was high and stained well. In one case there was well-marked periduct connective tissue, easily recognizable from the main mass of interstitial fibrous tissue by its looser texture and lighter staining. It is reasonable to regard periduct connective tissue as a "packing tissue," and as such an adaptation and an index to the activity of the duct. In this case with distinct periduct fibrous tissue the duct cells were high and stained well.

SUMMARY

Attention is drawn to the operation for gynæcomastia described by Dr. Jerome Webster of the Presbyterian Hospital, New York.

Its great advantages are the preservation of the nipple and the very inconspicuous scars.

A method of reducing an enlarged areola is described.

Results in 5 cases treated by this operation are given. When 200 grammes and more of breast tissue have to be removed the excess of skin remaining

causes some residual breast convexity, but this is generally within "normal" male limits.

I am indebted to Dr. P. M. F. Bishop, *D.M.*, Physician in Charge of the Endocrine Department, Guy's Hospital, for the reference of these cases. It is a pleasure, too, to acknowledge my debt to Dr. de Navasquez, M.D., Morbid Histologist to Guy's Hospital, for his opinion on the sections.

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- [1] WEBSTER, GEORGE V. (1944) Gynecomastia in the Navy. *Mil Surgeon*, **95**, 375-379.
 - [2] GILL, W. G. (1942) Gynecomastia or Male Mammary Hypertrophy, **28**, 333-341.
 - [3] WEBSTER, JEROME P. (1946) Mastectomy for Gynecomastia through a Semi-Circular Intra-Areolar Incision, *Annals of Surgery*, **124**, 557-575.
 - [4] THE SEVEN BOOKS OF PAULUS AEGINETA. Translated from the Greek by Francis Adams, Vol. II. Book IV, Section XLVI, page 334. London, Sydenham Society, 1846 (quoted by Dr. Jerome Webster).
-

A CONCEPT OF SOME OF THE PRINCIPLES INVOLVED IN THE TACTICAL EMPLOYMENT OF FORWARD MEDICAL UNITS

Being the Subject of a Lecture to the Senior Officers' Course in the Royal
Army Medical College in May 1949

BY

Major-General J. C. A. DOWSE, *C.B., C.B.E., M.C., K.H.P.*

THE Editors of most journals are careful to explain that the authors alone are responsible for the statements made and the opinions expressed in their papers.

I hasten to state that much of what I may say is the outcome of experience gained not only by myself but also by many others in two World Wars but many of my statements are my own opinion alone. I accept all responsibility for my remarks and cannot claim that some of the more provocative statements have received even a whimsical smile of official welcome.

In 1939 I had the temerity to write an article in the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS on Mechanization and the Modern Field Ambulance. I make no claim for originality but it is perhaps interesting to note that some of the suggestions made at that time found their way into our present-day organization. I hope, therefore, that if there be anything sound or constructive in my remarks it will find support and help to improve our organization and enable it, the better, to obtain its objective—Efficiency.

The Medical Services have certain tasks to perform in war which may be divided into several distinct yet interrelated components.

Amongst these tasks is firstly the *collection* and *evacuation* (where necessary) of the sick and wounded from a Fighting Force.

Secondly, the subsequent CARE OF THE SICK AND WOUNDED until they are returned to duty or invalided out of the service.

We are not concerned today with the third and very important principle—PREVENTIVE MEDICINE.

The first two principles have never changed throughout our history as a Medical Service but the *application* of the principles has altered with each successive war.

As I propose to deal with the Forward Medical Units only, I will confine my remarks to the first of the principles mentioned, though in passing some reference may be made to the others.

The medical units mainly involved in this discussion are the *Field Ambulance*, the *Field Dressing Station* and the *Casualty Clearing Station* and the non-medical unit, *The Motor Ambulance Company*.

The *primary* duty, therefore, of the Forward Medical Unit is the *collection, sorting and evacuation* of casualties.

The Medical Services of the Army gained a justifiably high reputation in the recent World War, often under very difficult circumstances. We were, in the main, fortunate in the fact that most of our essential requirements were met and—given the tools—we were able to finish the job.

There are, however, certain basic requirements, without which we cannot hope to obtain our objectives or fulfil our primary functions. I have tabulated these requirements and propose to take them in turn and see where they lead us.

These requirements are: (1) High-grade professional knowledge; (2) intelligent use of the resources available; (3) adequate numbers of medical personnel and medical units; (4) adequate equipment; (5) adequate transport; (6) adequate communications; and finally, a short discussion on the impact of the aircraft on medical tactics.

(1) *High-grade Professional Knowledge*.—You may possibly wonder why I state that there is a need in the forward area for high-grade professional knowledge. I will try to show why I consider this to be necessary and why I place it high in the order of essential requirements.

The principle that *speed* in the evacuation of casualties is a virtue needs no emphasis and should be the watchword of all efficient medical units in the forward areas.

In the first World War and, indeed, for considerable portions of the recent war, a sick or wounded man had to pass through a number of medical units in sequence, before he reached his final destination in the medical unit that could really give him the treatment that he required.

The Committee set up by Sir Alexander Hood during his Directorship and called the Hartgill Committee from the name of its Chairman, devised a system of Collection and Evacuation of casualties which aimed at the elimination of a number of staging posts through which a casualty should pass, a main feature of this conception was the *classification* of a casualty as far forward as possible and *evacuation* from that point *direct* to the medical unit in the rear which would most adequately deal with his particular case.

It was decided and practice showed that it was possible to attempt to carry out this classification at the Advanced Dressing Station and from that point evacuate the casualty to a Divisional, Corps or Army Medical Unit *direct* thus cutting out as many intermediate stops as possible and, in general, doing away with the old style *main* Dressing Station.

In this way the exhaustion case went direct to the Divisional or Corps Exhaustion Centre, the surgical case to the C.C.S. or on occasions to the Advanced Surgical Centre, the Sick to the Divisional "Rest" Station or the C.C.S.

In order to implement this method it is essential that a Field Ambulance should have medical officers who possess a sufficiently high standard of medical knowledge to enable them to make rapid and accurate *professional* decisions

and to place each sick and wounded man in his proper category for evacuation. This may sound easy but it is, in fact, far from being automatic ; it may be that the best answer is to have an officer trained in blood transfusion technique to perform this task. He will, from his special training, be able to recognize those cases that are in urgent need of surgical attention and place them in the appropriate section of the Advanced Dressing Station so that they are dealt with speedily.

This system of classification also implies an alteration in the tactical employment of the Motor Ambulance Company because formerly the Motor Ambulance Convoy sent its cars only to the Main Dressing Station, the Motor Ambulance Company now sends its cars to the Advanced Dressing Station thus freeing the cars of the Field Ambulance for work in the forward area or at any rate only for movement of casualties inside the divisional boundaries.

The Hartgill Committee also devised a new unit, the *Field Dressing Station*, a smaller unit than the Field Ambulance and intended for a number of uses, it is *not* primarily a *collecting* unit but is used in the Divisional Area as a Divisional Rest Station, and is found in the Order of Battle of the Division and the Corps.

When linked with one or more surgical Teams it can form an *Advanced Surgical Centre*. The intention of the Advanced Surgical Centre is to bring the surgeon to the patient thus providing a medical unit in which surgical procedures can be carried out well in advance of the Casualty Clearing Station.

It was fully realized that when forming an Advanced Surgical Centre that mere *operation* was not the completion of perfect surgical technique and that *post-operative* care, almost impossible in such a unit, was of the greatest importance but at the same time there were occasions in the rough and burly of war that the distance from the A.D.S. to the C.C.S. meant that the seriously wounded man could not survive the passage until his injury had received skilled surgical attention. In other words, the tactical situation might not permit the C.C.S. being brought sufficiently far forward to make speedy evacuation possible, or the terrain over which the fighting was taking place made evacuation to the C.C.S. both difficult and prolonged. In these circumstances an Advanced Surgical Centre, sited well forward in the Corps/Divisional Area, had its uses and many a life was saved although the overwhelming consensus of expert professional opinion has demonstrated that the optimum site for surgical work is the C.C.S. where it is possible to provide and maintain adequate post-operative attention.

An Advanced Surgical Centre will, therefore, only be formed if in the opinion of the A.D.M.S. Division, the D.D.M.S. Corps and the D.M.S. Army, it is impossible to ensure that urgent surgical cases can be brought to the C.C.S. without undue delay and shock due to travelling. The planning which takes place before each battle will include the consideration of the necessity for forming an Advanced Surgical Centre and the *Consultant Surgeon* to the Army should be "in" on all such planning.

Whilst I recognize the uses of the Advanced Surgical Centre I sincerely

trust that improved and rapid evacuation with the assistance of air lift for casualties largely will do away with the necessity for these units in the interest of the wounded man.

(2) *Intelligent Use of the Resources Available.*—One of the first duties of a Commanding Officer of a forward medical unit is to study his equipment in detail, he *must* know what he has got and what he can *do* with the material supplied, he must realize the limits within which his equipment, transport and personnel can function. He must not allow his mind to become too stereotyped.

The majority of his equipment is designed to perform certain functions and will do so with adequate efficiency ; much of it is also capable of being used for purposes other than that for which it was designed, for example, a tarpaulin can be used for making the outer shell of a raft to ferry casualties over water or form the lining of a bath. In carrying out practices it is well to try and tabulate the many and varied uses to which the equipment can be put and to get personnel accustomed to numerous methods of improvisation. All this implies some chance to get experience in the equipment and the lay-out of a Field Unit in peacetime so I trust that the new school of *Field Medical Training* will provide some of this experience for potential Field Ambulance Commanders of the future.

The A.D.M.S. of a Division has at his disposal four very handy units, by working the changes in their employment he can, as a rule, produce the answer to most of his evacuation problems without having to get assistance from outside, at the same time he should remember that the Sappers and the R.E.M.E. are equipped to deal with their own special problems and very often can be of great assistance in providing bits and pieces which his own equipment lacks and for which there is no practicable improvisation possible.

I mentioned the danger of becoming too stereotyped, by that I mean losing flexibility by attempting to run every set-up of the Field Ambulance on exactly the same lines. Each and every engagement is something different and will require a separate plan whilst employing the same basic principles which never alter. For instance, an Advanced Dressing Station will always require a reception area, a treatment area and an evacuation area, the functions of each are quite definite, the training of the personnel must be that each officer and man is quite conversant with what he has to do, where he is to get his necessary equipment and the general plan for the lay-out of the area he is to work in. Having chosen, by reconnaissance, the new site of the Advanced Dressing Station an officer or N.C.O. should be detailed to peg out the new areas for each section of the medical post.

As far as possible, the packing of the load carrying vehicles should be so arranged that the vehicle and its contents can be sent to unload as near as possible to the allotted area, so that the personnel may be able to start preparing the area without delay ; the unit should work as a series of teams, each team allotted a specific task and capable of getting on with the job without delay when ordered to do so. The Officer or N.C.O. detailed to lay out the post should be given all possible information as to what the post is expected to

provide, the numbers and types of expected casualties, the necessity for an Air Strip, etc. Close liaison with Brigade H.Q. and a study of the battle plan will provide the Commanding Officer with the information that he requires which he should transmit to his staff at his conference before the fight begins.

During active operations it is never waste of an officer to keep a liaison officer permanently with Brigade H.Q. in close contact with the Brigade Major or Staff Captain so that the Field Ambulance may receive the very latest information of the situation and the movements and locations of the attacking troops.

In a war of movement, circumstances change with great rapidity, the staff is working at high pressure, messages are sent out giving priority (quite rightly) to the fighting troops, so that unless the Field Ambulance Commander has a close link with the Brigade H.Q. he will find that he is behindhand with his information. The Field Ambulance Commander must see to it that he keeps his A.D.M.S. well in the picture so that the A.D.M.S. may, in turn, be able to organize his resources to fit the tactical situation. Major changes in the tactical employment of the Division will naturally come from the Divisional H.Q. but once a fight is joined the Brigade Commander is left to fight his own battle so that the Field Ambulance Commander should be in possession of up-to-date information which he must communicate to the A.D.M.S. through his wireless net or by other means.

(3) *Adequate Numbers of Medical Personnel and Medical Units.*—The chain of collection and evacuation of casualties commences in the fighting unit with the *Regimental Medical Officer* who is the first link in that chain ; he is indeed (to mix the metaphor) the linch pin upon which much depends if the casualty is to have the benefit of the highly organized medical assistance available behind the fighting unit. The R.M.O. is, in my humble opinion, one of the most important individuals in the whole of the Medical Services ; every encouragement and assistance should be given to improve his status by those responsible for the administration of our Corps, for, to repeat a trite observation, a *good* R.M.O. is worth his weight in gold as many a Commanding Officer of a fighting unit will testify.

Apart from his daily routine work in the maintenance of the health both physical and mental of his unit, he is, in war, the first line of skilled medical attention that the wounded man meets, on his shoulders lies the responsibility for co-ordinating the medical arrangements of his unit.

A medical officer in a Battalion on the Higher Establishment, i.e. War Establishment has 1 Sergeant and 5 R.A.M.C. Corporals and 1 Sergeant and 20 Regimental Stretcher Bearers to assist him.

Warfare is a highly specialized undertaking in these modern days. If one is to expect efficiency those that take part must have a high degree of technical training, further an adequate system of replacement of casualties must be organized so that the loss of one trained man may be made good at once.

I have long considered that *all* the Regimental Stretcher Bearers should be R.A.M.C. personnel and *not* rank and file of the Regiment. During active operations it is almost impossible for the R.M.O. to train replacements, there-

fore all replacements should come from trained personnel in the Divisional R.A.M.C. who in turn find their reinforcements from the base in the ordinary way. A step in the right direction has been made in introducing R.A.M.C. personnel on the staff of the R.M.O. with a Battalion, this scheme should be carried further so that there is a complete and highly trained section with the Medical Officer composed of men whose training has been *basically* that of the R.A.M.C. The art of first aid and the collection of casualties in battle are things which should now be recognized as specialist subjects and not left to individuals who may make poor stretcher bearers through lack of adequate training and also become (and this is almost the crux of the whole matter) a drain on trained fighting men when casualties have to be replaced.

There are plenty of instances where men of one unit, specialists in their own line, are attached for duty with another unit, for example the L.A.D.s or the R.A.S.C. with a Field Ambulance. Our American Allies recognize the importance of attaching *medical* personnel to the fighting unit ; we would do well to copy them and do away with old prejudices which have little to recommend them apart from some spurious sentimentality. In war, efficiency is more important than sentiment.

The next link in the chain is the Field Ambulance, of which there are three in the normal Division. The Field Ambulances are *Divisional Troops* though for most of their existence they will probably work with "their own" Brigade. The A.D.M.S., however, commands all three Field Ambulances and can allot them to whatever duty he desires.

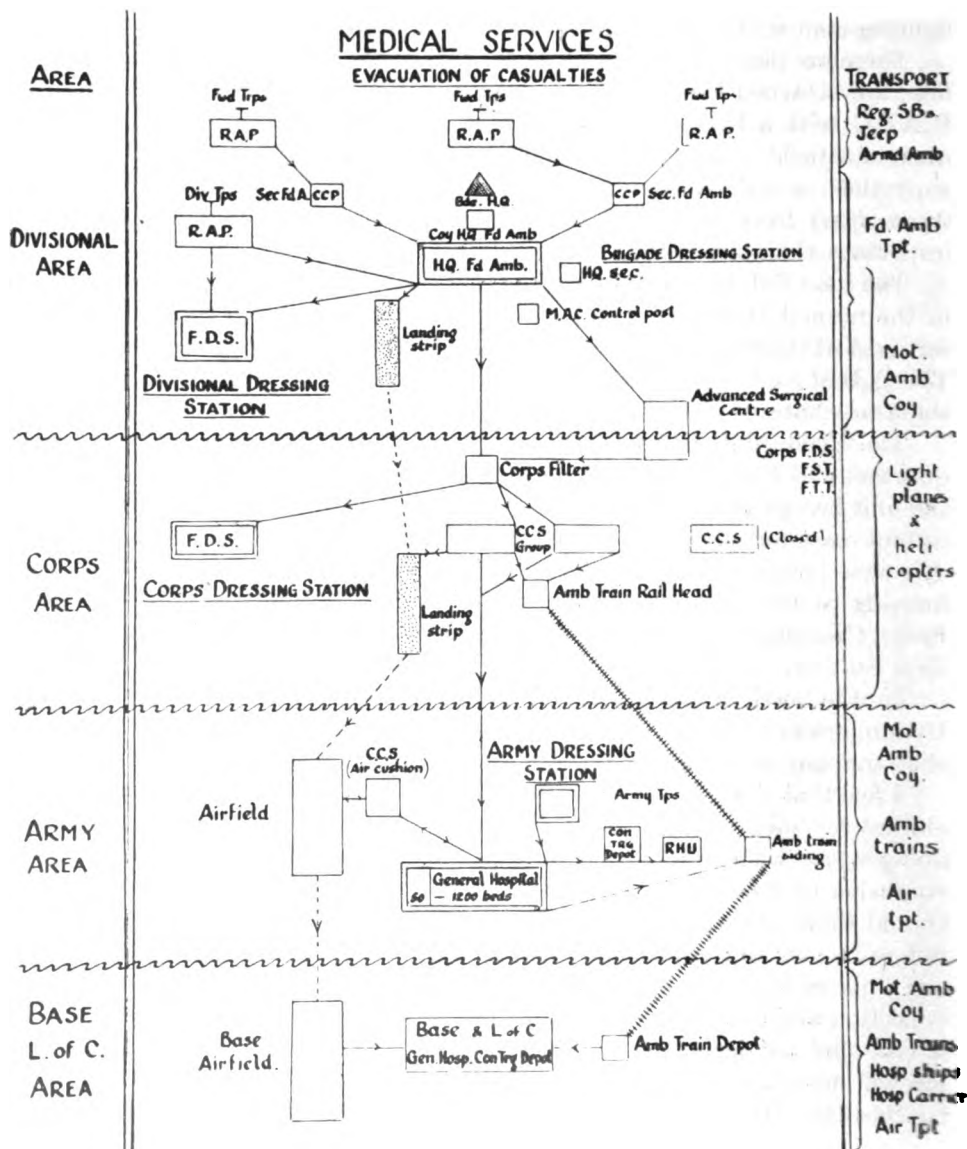
The Field Ambulance is designed to be a highly mobile unit with Headquarters and one Section and a Company with three Sections, any portion of the unit being capable of independent action, but the Company or the Sections cannot exist for any great length of time separated from their H.Q. and must of course be maintained by the H.Q. The unit is flexible and capable of performing almost any combinations of functions from the formation of Car Posts, Casualty Collecting Posts to Advanced Dressing Stations or a Divisional Rest Station.

In the modern conception of the functions of a Field Ambulance the Headquarters forms an Advanced Dressing Station in the Brigade Area whilst the Company and the Sections are employed in the collection of casualties.

I feel that the time has come to make sure that we have the correct nomenclature for these medical posts, for since the introduction of the concept of doing away with the *Main* Dressing Station, as such, there has been some confusion of thought as to exactly what we mean. The intention is that we should limit the number of medical units through which the casualty passes before he gets to the unit that can really deal with him. Thus we envisage but *one* unit in the Brigade area of the Division *primarily* concerned with the collection and evacuation of casualties to which the casualty is sent, where he is classified and despatched to the place where he will receive expert attention. He will not pass through first the A.D.S. thence to a M.D.S. before he finally reaches the C.C.S. or other specialized medical unit.

The present-day A.D.S. really undertakes the combined function of the A.D.S. and the old M.D.S.—so—to avoid confusion I suggest that we now designate an A.D.S. a *Brigade Dressing Station*. If a Field Ambulance opens a Rest Station or a Field Dressing Station opens in the Divisional area as distinct from the Brigade area such a medical post might be designated a *Divisional Dressing Station*, whilst a medical post in the Corps area would be a *Corps Dressing Station*, similarly in the Army zone we might find an *Army Dressing Station*, vide chart.

A Possible Set-up for a "Forward" Collection and Evacuation Scheme.



This terminology will, at once, by indicating the geographical location of the medical post, describe its functions and at the same time do away with another prevalent misconception that the Field Ambulance can only be "used for" the formation of an Advance Dressing Station.

There was a tendency during the recent war amongst some die-hard and very conservative medical administrators tacitly to accept the new function of the Field Ambulance Headquarters but to expand the Casualty Collecting Post with the Company and the sections so as to turn it into an *Advanced Advanced* Dressing Station and so permit the old evil of constant transshipment of cases before the wounded man really reached his proper destination, this tendency must be scotched and if we must have the term Casualty Collecting Post it must merely be a point where heavy cars take over from Jeeps or a relay post so that the supply of cars forward to the region of the R.A.P. may be adequately maintained, only in the rarest instance has the C.C.P. a function as a "Dressing Station."

As the Headquarters of the Field Ambulance forms the first medical unit to which casualties from the fighting troops are evacuated, it is at this advanced post that *classification* takes place (I think that it is time that we gave up that somewhat unfortunate word *triage*), here they are sorted out and classified into the various degrees of severity and type by officers trained in this difficult but essential work and from the Dressing Station they are evacuated *direct* to the medical unit on the lines of evacuation that can most adequately deal with the individual needs of each case.

The Field Ambulance will now have completed two of its functions, the casualty will have been collected from the R.A.P. and will have been *classified*. The personnel of the unit is well able to perform both these functions, the first is facilitated by very close liaison with the R.M.O., it is often very sound to attach one or two stretcher-squads or a Jeep ambulance car to the R.A.P., in any case the C.C.P. should be as close to the R.A.P. as it is physically and tactically possible, so that constant touch can be maintained between the R.A.P. and the collecting unit, for it is, of course, the responsibility of the Field Ambulance Commander to keep the R.A.P. free of casualties.

The second function when completed brings into play the Motor Ambulance Company whose duty it is to carry the casualties to whatever destination the officer in charge of evacuation may direct.

My experience taught me that *here* was a possible weak link in the otherwise excellent plan. The officer in charge of the Motor Ambulance Company must be kept fully in the picture, he must have accurate and up-to-date locations of the medical units in his area, he must so organize his unit that he can ensure that the drivers know where to go when given instructions and insist that once having received orders to deliver patients to a specific medical unit, the patients do arrive at *that unit* and not another possibly in the vicinity. There was at times a tendency for the ambulance driver to decant his load into the first medical unit he saw to the rearward of the A.D.S. irrespective of his real destination. All ambulance cars should be equipped with maps. Written

instructions giving full map reference and name of the medical post should be given to *each* ambulance driver before he leaves the A.D.S. control post, he should also have instructions where he should report after he has delivered his load of patients. These important details entail a high degree of administrative planning on the part of the Motor Ambulance Company, without such planning the whole somewhat complicated system will break down.

In general, the cars of the M.A.C. will be used to transport patients to medical posts *outside* the divisional area such as the C.C.S. or to posts which are not under divisional control, whilst the cars of the Field Ambulance will be used on work inside the Division and should not normally be called upon to work outside the divisional area.

The numbers of the Motor Ambulance Car Company vehicles at the disposal of the "open" Field Ambulance will be decided by the A.D.M.S. when he receives his allocation from the D.D.M.S. Corps. The co-ordination of this evacuation from the forward area is one of the most important functions of the A.D.M.S. and his staff during active operations.

As a rule the A.D.M.S. will have enough cars to carry out this function but shortage of casualty carrying vehicles can be a very real problem when the lines of evacuation lengthen as a Division advances. A rough and ready estimation of the number of cars required to maintain an even flow might be expressed in the following manner. The number of cars required or available at the commencement of the battle will be known, one additional car in every group of 20 cars will be required for each mile of the advance.

$$\begin{aligned}\text{If } X &= \text{number of cars initially required} \\ Y &= \text{number of cars required after advance} \\ Z &= \text{miles of advance} \\ Y &= \frac{(X + 1) \times Z}{20}\end{aligned}$$

In addition to the three Field Ambulances in the Order of Battle of the Division there is now the new unit the *Field Dressing Station*.

The *Field Ambulance* is intended to be a highly mobile collecting and evacuating unit and is required to be able to move at short notice to perform its legitimate functions but in the Division there is the need of a unit, which though equally mobile, could act as a Divisional Dressing Station and to which exhaustion cases and the mild sick might be sent for a few days to recover and so avoid evacuation, the "resting" Field Ambulance could easily perform this function but once committed to such a role is tied down till it can dispose of its patients and would not be able to fulfil its normal role if called upon, suddenly, to do so.

The addition of the Field Dressing Station overcomes this disadvantage and adds very considerably to the medical potential in the Division.

The general design of the Field Dressing Station is such that it can perform a number of functions and it can with the addition of one or more Surgical Teams form an Advanced Surgical Centre. It should be *very* unusual for the

Divisional Field Dressing Station to be asked to form an Advanced Surgical Centre, such a Centre should be formed with one of the Field Dressing Stations attached to the Corps. The decision for the necessity for an Advanced Surgical Centre should, I repeat, be decided by the Medical Staff of the Army or Corps as soon as the "G" plan for the battle is known and the tactical deployment of the medical troops finalized.

It has been stated that the ratio of medical troops to the overall strength of the Army has remained constant at about 4 per cent through two world wars whilst the ratio of the other services forming the "*tail*" has risen very considerably. I think the answer really is that the ratio of medical troops *in the field* in an Army Corps or Divisional Area has increased but, owing to the fact that during the late war the greater majority of hospital beds in the United Kingdom were run by the Emergency Medical Service and not by uniformed R.A.M.C., a vast proportion of the medical troops were on active service in the Field and not as in the First World War absorbed, in large numbers, in manning the Home Base Hospitals; this would result in leaving the ratio of R.A.M.C. personnel to the rest of the Army static whilst not representing the total numbers of medical personnel actually looking after military sick and wounded.

The formation of the Field Dressing Station has in itself added very considerably to the numbers of medical troops in the Field.

In general, I see no reason why we should increase the numbers of forward medical troops except in the two instances that I mention in this paper, where I advocate that the Regimental Stretcher Bearer should belong to the R.A.M.C. and that the drivers of our medical vehicles should also wear the R.A.M.C. cap badge, thus increasing the numbers of medical troops with the corresponding decrease in the "*teeth*" of other arms.

(4) *Adequate Equipment*.—It is obviously impossible to design the equipment of a forward medical unit which will be capable of meeting all the demands that may be made upon it—in any country, in any climate or over any terrain throughout the world where our troops may be called upon to fight.

The equipment of the Field Ambulance and the Field Dressing Station has been designed to meet a very large number of these varying conditions but in the main is based on the known requirements gained by experience in two World Wars, in a temperate climate and in a reasonably developed country. It is in conformity with the equipment of the fighting force with which these medical units will work. If that fighting force is to be asked to operate under Arctic conditions or in a tropical jungle its equipment will be modified accordingly, so, too, will the equipment of the medical units that are detailed to accompany that force. This fact must be remembered by the medical planners when making up the proposed medical backing for any expeditionary force.

The equipment of the Standard Field Ambulance has been so designed as to make the various sub-Divisions of the unit capable of independent action for a reasonable time, this needs careful planning and attention to essential

details, particularly the comfort of the personnel, their feeding and the feeding of their patients. The Headquarters of the unit carries the bulk of the equipment but the sections carry sufficient to enable them to perform their normal roles. The Field Ambulance Commander must so organize his unit that he can, at very short notice, reorganize the distribution of his equipment to meet local requirements. In general, the H.Q. forms the A.D.S. or as I prefer to call it the Brigade Dressing Station, whilst the Sections are largely employed in the actual collection of the casualties and their transfer to the H.Q.

The A.D.M.S. and his Field Ambulance Commanders must study the problem of "*conservation of energy*." Many items of the Field Ambulance equipment are only required under a certain set of circumstances, the packing of the vehicles should aim at the supply of essentials at once so that only the minimum number of personnel and the smallest quantity of equipment, consistent with efficiency, are committed at any one time. This will ensure that adequate reserves are available to meet sudden emergencies. It is rare for all three Brigades of a Division to be "up" at the same time but even when a Brigade is in reserve the Field Ambulance that normally works with that Brigade is frequently employed in Divisional duties. It is here that the Field Dressing Station is so useful so that the reserve Field Ambulance may be kept fully mobile and "at rest"—ready to relieve one of the hard pressed units that became involved at the commencement of the fighting. I stress again that the Field Ambulances are divisional troops and must not be considered to "belong" to any particular Brigade even if they are for long periods "Brigaded."

In the course of time every unit acquires additional equipment; the consequences of this habit are discussed later.

(5) *Adequate Transport*.—The transport allotted to the Standard Field Ambulance and the Field Dressing Station is designed so that the whole unit is fully mobile, all the *authorized* equipment can be carried and the personnel assured of transportation.

The individual items of the equipment and the vehicles required have been selected after an exhaustive review of the experience of many Commanding Officers of these Field Units during the War of 1939–45. The resultant Field Ambulance is a great and necessary advance on the older type of unit where about one-fifth of the personnel could not be provided with accommodation in the unit transport whilst on the move.

The vehicles require very careful packing to ensure that all the equipment can be suitably housed and the individual vehicle not overloaded, there is *no* room for the many extraneous articles that a unit "collects" on active service. Commanding Officers must pay particular attention to ensure that unauthorized articles are not accumulated and placed on the vehicles to the detriment of the safety margin of the axle loads of the vehicles. I know of several units whose accumulated stores required double the number of allotted vehicles when the unit moved, this is a very common and a possibly understandable practice with the C.C.S. but it is not unknown in the Field Ambu-

lance. I have found, however, that when the allocation of vehicles has come up for consideration by the planning committees that too little attention has been paid to the fact that our medical units have not only to allow for their own internal economy in the allocation of space but they have also to carry loads of material which are for the sole use of their patients, in particular, rations, which require one additional vehicle for this purpose alone. Further, in the breaking down of the bulk mobilization G.1098 and I.1248 into suitable packages the resultant invariably means more *space* is required even though the total load may be well within the weight-carrying capacity of the allotted vehicles. In practice, on active service, the Field Ambulance is constantly required to carry stretchers and blankets additional to the mobilization equipment. These practical points require careful review in planning the number of vehicles that should be allocated to the mobilization equipment of our forward medical units and suitable allowance made if we are to have really efficient units in war.

As already mentioned, the transport and the equipment of the medical units should conform to the type employed in the fighting arms they serve, this is particularly so in the case of Ambulance cars. The medical unit working with tracked or armoured formations requires tracked and armoured ambulance cars if it is to be capable of performing its proper role. In the same way, the transport of a Field Ambulance working in the jungle may have to be animal pack. Alterations in the type of transport will invariably mean that the equipment will have to be modified so that it can be carried in suitable packages depending on the type of transport provided.

The standard ambulance car for use in the forward area requires certain characteristics, it should have a low silhouette, a four-wheel drive and high power to weight ratio, it is hard to combine the first of these requirements with the carriage of more than two stretchers but in any case the Field Ambulance requires a large number of the smaller type of vehicle which can negotiate the difficult terrain found in the fighting zone. It was proved beyond question in the late war that a Jeep fitted with one or two stretchers was an excellent forward ambulance vehicle, it was equally true that the same vehicle fitted with a double-tier carrier for stretchers was *not* a success, the inevitable swaying due to the low centre of gravity of the vehicle in relation to the height of the upper layer of stretchers made it impossible to ensure the comfort of the patients on the upper layer. I have actually seen patients thrown off when the vehicle was moving over very broken ground, even though they were supposedly strapped in.

The larger ambulance cars and even those used by the Ambulance Car Company in the forward area also require a four-wheel drive.

This is perhaps the moment to throw a large spanner into the works and mention the question of the driver of the "Red Cross" vehicle. The R.A.S.C. at present supply the personnel to drive all our medical vehicles and have done the job in a most praiseworthy manner, however, the infantry man, the sapper, the signaller, the gunner, all drive their own vehicles and I can see

no reason why the R.A.M.C. should not do the same, in fact I consider that there are a great many advantages in having R.A.M.C. personnel in charge of all vehicles marked with the Red Cross and further, is there any reason why all our load-carrying vehicles should not be marked with that emblem? I fully realize the implications of this suggestion but is it not logical, even if logic goes a very little way in competition with expediency?

If for no other reason, to implement this suggestion would make it very much easier to draw up the regulations covering the protection of military personnel under the Geneva Convention if all the personnel involved in the handling and carriage of our sick and wounded wore the cap badge of the R.A.M.C. To bring such an idea into effect will require determination and persistence to overcome the undoubted objections from many interested parties.

(6) *Adequate Communications.*—Signal communications in modern warfare have become more and more complicated, the increased mobility of the fighting troops has only tended to make intercommunication between units and their headquarters and between different portions of a unit not only more essential but also more difficult to maintain.

If a unit is employed in an *operational* role it must be supplied with every possible modern means of intercommunication both between its own immediate commanders and the headquarters of the formation it serves. It is, unfortunately, still constantly necessary to insist that recognition is given to the undoubted fact that the forward medical units are 100 per cent *operational*.

The absolute necessity of adequate communications throws a heavy strain on the Royal Corps of Signals, which in turn makes it the more essential for individual units to be as self-contained as possible and responsible within reasonable limits, for the training of their own personnel in the maintenance of their own communications.

It is realized that the enormous demand for wireless communication is an embarrassment to the authorities, against that must be placed the comparative importance of particular requirements. In my opinion, the Medical Services dealing, as they do, with life and death of individuals and groups must come high in the priority scale for the supply of wireless. The Field Ambulance which is the spearhead of the medical system in the Division must have every possible chance to maintain its communications in an adequate manner. This implies the allocation of a wireless link not only between the Field Ambulance Commander and his A.D.M.S., but also between the Field Ambulance Command and his Company Commander.

The requirements of the Field Ambulance have been recognized in the latest edition as at January 1949 of the set-up for an Infantry or Armoured Division wireless communication plan, where each Field Ambulance has a 62 set and the A.D.M.S. a 19 set with a 19 set link to D.D.M.S. Corps. I say that the need has been recognized but I do not mean that it has been fully met by the allocation of the wireless sets mentioned. The A.D.M.S. undoubtedly

wants a "Rover" if he is to carry out his job properly; C.R.A.S.C. and C.R.E.M.E. have such a machine, I submit that the needs of the A.D.M.S. are at least as great as either of these services. The Field Dressing Station has no wireless at all, there is little doubt that even with this unit wireless is highly desirable, many view it as an absolute necessity.

The present allocation caters for the O.C. Field Ambulance-A.D.M.S. link but the point where constant and urgent communication is required is in front of the Brigade Dressing Station between the R.A.P., the Company Commander and his C.O. It is here that the development of the Walky-Talky wireless instrument will open up another excellent method of keeping touch. The only wireless method of getting news through at present is along the Battalion-Brigade net which is both chancy and suffers considerable delays. A link is therefore required in the forward area which will connect the R.A.P. with the Company Commander in charge of evacuation and thence to the C.O. of the Field Ambulance. I suggest, therefore, that our planners investigate this possibility in making their future recommendations and close this very important gap in our intercommunication scheme.

I have mentioned the necessity of training our personnel in the use of wireless, it is quite essential that we should do so and we must if necessary be prepared to sacrifice a number of our all too few other ranks so that we do not fail to maintain our essential medical communications through lack of even semi-trained personnel. Every officer and N.C.O. in our units must be thoroughly versed in the operation of the instruments provided, this makes one more "qualification" to the mass of knowledge that the Officer or N.C.O. must assimilate if he is to consider himself fully trained to take his place in modern warfare.

The addition of the wireless as a means of communication must not be permitted to become the *only* means of intercommunication, full use should be made of the Dispatch Rider and a regular system of D.R.L.S. between the Field Ambulance Commander and the A.D.M.S. maintained, the non-arrival of the scheduled service should be looked upon with suspicion and steps taken to find out the cause.

I feel that I must digress here for a moment.

I view with considerable alarm and not a little despondency that in the Signal Lay-out the A.D.M.S. of a Division is still being shown as being located in *Rear Divisional Headquarters* with his command vehicle containing his wireless.

As an operative A.D.M.S. in the late war and on many occasions in other appointments I have constantly stressed the point that the A.D.M.S. being an *operational* Commander *must* be located in Main Divisional Headquarters in exactly the same way as the C.R.A. or the C.R.E. If this is not done I go as far as to say that 80 per cent of his efficiency in handling his medical units is lost and he is placed in a situation which makes the tactical control of his medical units virtually impossible; a position which no other *operational* Commander is asked to adopt.

In practice the A.D.M.S. sees to it that he does not remain in Rear H.Q. but until it is formally recognized that his place is with the Main Headquarters adequate provision even for his accommodation is always on the "Old Boy" basis, depending to a large extent on the personality of the A.D.M.S.—this is entirely wrong.

The A.D.M.S. with his Deputy and his Staff should be shown in the Divisional Headquarters lay-out as belonging to Main Headquarters and not lumped with "other service" in Rear Headquarters.

The Impact of the Air Craft on Medical Tactics.—This subject is of such paramount importance that it should really form the main basis of a discussion on its own, for, in attempting to discourse on the future handling of our forward medical units the place of the aircraft in our tactical conception will undoubtedly hold a very important position.

The basic principle which underlies every action of ours in the forward area is *rapidity* of Collection and *evacuation*.

If an individual or a collection of individuals is asked to perform a certain task it is only fair and just that every possible means to obtain the avowed objective should be provided ; thus, personnel, equipment and transport must be available at all times and under the direct supervision of those responsible for the efficient performance of the work in hand. To this end we have devised the Field Ambulance for the collection of the casualties, the Ambulance Car Company, the Ambulance Train and the Hospital Ship for their evacuation.

All the various units that we now have at our disposal for the evacuation of casualties may not be medical units, as such, but they are under the control of the Medical Services—specifically set apart for dealing with casualties and not available for use by any other formation in any way whatsoever. This principle was finally accepted as just and essential in 1915 when Ambulance cars were provided for the Medical Services as an integral part of the medical organization. It took some time and much argument to establish this principle but in the end everyone from the highest command in the Army downwards agreed that if there was to be an efficient Medical Service complete independence in the use of medical vehicles must be accepted.

During the late war the aircraft was shown to be a most excellent method of transporting casualties, many hundreds of thousands of sick and wounded were carried in aircraft of all sizes and shapes, so common did this method become that in certain theatres of war it was the accepted method of moving casualties from the forward areas to hospitals situated on the Lines of Communication.

I have not yet found any responsible person who does not maintain given certain essentials, one of which is flying weather, that the aircraft is a great advance on any other method of conveyance of our casualties, particularly from the forward areas but I have still to find a responsible authority who is prepared to back the contention that the Medical Services must have their *own aircraft exclusively and entirely as "Medical" vehicles*, every conceivable argument is used against accepting the fact that to be efficient the Medical

Services must have what aircraft they require entirely at their own disposal and not coming from a pool of suitable aircraft.

It is quite essential, therefore, for us as a Medical Service to establish the fact beyond all cavil and doubt that just as we had to have Ambulance Cars we must have Ambulance Planes. The arguments in favour of this principle are well laid out in the official correspondence which has been proceeding at high level for some years past and I trust that, in the end, common sense will prevail.

I would like to say straight away that I do not contend that the aircraft is the be-all and end-all of medical evacuation, it has its limitations and it is merely another highly efficient method of assisting the Medical Service to obtain their objective of *rapid* evacuation. On the other hand, I do maintain that it is an absolutely essential addition to our present armamentarium and should be developed to the utmost.

The ideal to be aimed at is the supply to the Medical Services of the Army and the Air Force of squadrons of aircraft both light and heavy, set apart exclusively for the use of the Medical Services, marked in some way that will indicate that they are purely medical machines and not available for use by the combatant forces whilst so marked, in the same way as the Ambulance Car and the Hospital Ship is at the present time.

As we are dealing with the requirements of the forward medical units I do not propose to discuss in detail the use of the heavier type of aircraft but will confine myself to the requirements for the evacuation of cases from the more forward zones in the light aircraft.

The required type of aircraft needs some discussion. We want a machine in the forward areas which has several specific characteristics, it must be capable of carrying at least one and preferably two casualties on stretchers with an attendant, it must be capable of landing and, more important, taking off in confined spaces with a short run such as one finds in forward landing strips. There are a number of *light* aircraft that already possess these characteristics. One realizes that the moment a demand is made to increase the possible load, the size and power of the machine increases and it becomes more and more difficult to make use of such a machine in the more advanced forward area.

The experiments being carried out with the Helicopter would make it appear that this type of machine carries most of the answers if the mechanical and other technical difficulties can be overcome and I see no reason to doubt that they will.

As the main object of the employment of the light aircraft for the evacuation of casualties is to speed up the evacuation time, the aircraft must be used from as far forward as it is tactically possible to place the landing strip, so that the distance from the Regimental Aid Post via the Brigade Dressing Station to the landing strip is as short as possible. Further, if we are to make intelligent use of the possibilities of air evacuation the Brigade Dressing Station will not have to be sited so that the cases can be transferred to the

aircraft without having to travel too far by road to reach the landing strip. This requirement brings out an important feature in the subsequent planning of the siting of the Brigade Dressing Station, in general we can say that the Brigade Dressing Station is located in the Brigade area near the position of Brigade Headquarters, it may well be that a position such as this may be too far forward to warrant a landing strip, thus the location of the Brigade Dressing Station of the future (where it is proposed to make use of light aircraft) will be dictated to some extent by the availability of a landing ground, possibly rather farther from the actual fighting zone than has been the practice up to date.

I am convinced that the *ultimate* gain in time of evacuation will make up for the increase in the distance from the R.A.P. to the B.D.S. but if we can develop the Helicopter or some similar machine even this drawback to the use of the light aircraft will go as these "hoverflies" will be able to make use of landing spaces which are out of the question for ordinary types of light aircraft.

The advent of the aircraft in our medical lay-out naturally adds complications not only in the immediate forward area but also at the terminus of the light aircraft flight, namely at the Casualty Clearing Station, this medical unit will also require a landing strip in close proximity. We are faced with another yet similar problem here—is the C.C.S. to conform to our present ideas as regards its siting or can we now be content with a C.C.S. some ten or twenty miles farther back (i.e. less than half an hour's flight in a casualty carrying aircraft)? I mention this point because if we have accepted the idea of carrying a large number of casualties by air from the forward areas surely we also contemplate carrying them to the Base Hospital by air from the C.C.S., if we do, we then require medium aircraft with a greater patient lift, which, by virtue of their size, require a bigger airfield on which to land and take off, the ideal would of course be for the C.C.S. group to have its own landing ground quite distinct from landing grounds used tactically by the R.A.F., time and the available personnel to build such grounds would doubtless be the deciding factor. These considerations may force the C.C.S. to be sited close to, but not right on top of, a suitable landing ground, such medium landing grounds are not, as a rule, as far forward as the usual site of the C.C.S. which in turn may cause the C.C.S. to be set up rather farther back than the accepted distance up to date.

I am convinced, however, that the *absolute* essential is to provide a landing strip near the C.C.S. for the light aircraft coming in from the forward area as our aim is to get the wounded man to the C.C.S. *rapidly*. His further evacuation can be a more leisurely affair accomplished by further evacuation by light craft to re-emplane in a heavier machine at a suitable airfield on the L. of C. or evacuation to the same airfield by Ambulance Car.

Our vision of the future, which should not be looked upon merely as a Hashish Smoker's dream, might take the shape of a complete air evacuation service within the Order of Battle of an Army in the Field, of squadrons of light, medium and heavy aircraft, maintenance units and an airfield con-

struction unit *entirely* at the disposal of the D.M.S. of the force. I am sure that public opinion, if nothing else, will insist that such a scheme shall be the accepted standard for our wounded—development on these lines is gaining ground rapidly with our American allies and we in the British Army must not, and dare not, lag behind.

I feel that in formulating our ideas on the evacuation of casualties from the forward areas by air we should get our minds clear both as to the possibilities and the limitations of this form of casualty evacuation. There are the obvious technical limitations imposed on all forms of flying by weather and the possession of air superiority and many other factors; however, we must study the strains and stresses placed on the badly wounded man from the time that he receives his injury until he arrives at a suitable centre and see what is the best for him.

If one takes the worst type and attempts to legislate for him those of less severity will be less of a problem.

A number of desperately wounded and exsanguinated casualties arrive at our Brigade Dressing Stations, if such men are to be given any hope of survival immediate and urgent attention must be provided and resuscitation commenced at once and maintained until the shock has been overcome and his condition radically improved. Any movement, by whatever means, will only throw them back and make subsequent recovery almost impossible. The chance of survival of this type of case is always tenuous and we can but do what is possible in the forward area and trust that recovery will be sufficiently marked to permit of movement later.

The great mass of wounded, however, arriving at the B.D.S. are of less severity than these extreme cases; they all require considerable attention as soon as they arrive but become ready for evacuation reasonably quickly. They are *in reality* in no fit state to stand the inevitable bumping and jolting inherent in being transported over the war-wrecked roads of a forward area; however, if they are to be given the attention they so urgently need they *must* be moved. The deterioration in their general condition on their arrival at their destination has to be accepted as road evacuation is the only means at the disposal of the Commander of the Field Ambulance. If, on the other hand, by providing light aircraft in the immediate neighbourhood of the Brigade Dressing Station by means of which we can transport these cases smoothly and rapidly to the C.C.S., 90 per cent of the additional shock caused by road transport is avoided, it will surely be the exception for the light aircraft to have to rise to such a height as to seriously interfere with the comfort of the patient from height alone. Even in Burma it was rare for the light aircraft to have to clear hills higher than 6,000 feet.

I know that the pundits have drawn up a list of the types of cases that are unsuitable for transport by air but *in the forward area* we have to ask ourselves one question and one question only—will this case arrive at the C.C.S. in a better medical condition if I send him by air for a comparatively short distance or are his chances better being bumped about on shell-pocked roads or up and

down jungle paths, taking anything up to ten times as long to arrive ? I am convinced that the answer will be—*by air* in 99·9 per cent of cases. If that is the answer then we *must*, and keep on repeating the *must*, have the medical aircraft to enable us to relieve the wounded man of so much suffering and danger inherent in our present antiquated method of road evacuation.

I have tried to put before you some of the problems of our forward medical units. We are now in the springtime of the post-war era, when ordered growth and development should be possible. Now is the time to put our house in order and not wait as we did before the recent war, until the winter of our discontent was fully upon us. May I therefore leave these problems for your consideration :

- (1) To replace the Regimental Stretcher Bearers by R.A.M.C. personnel.
 - (2) To replace the drivers of our vehicles by R.A.M.C. personnel.
 - (3) To improve our wireless communication in the Division.
 - (4) To see that the A.D.M.S. has his rightful place in Main Division H.Q. and *lastly*, and very very important, to *insist* that the Medical Services have their own *Air Ambulance Planes*.
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PURIFICATION OF WATER ON A SMALL SCALE

BY

Major H. J. ANDERSON

Royal Army Medical Corps

THIS rather brief title refers mainly to the purification of water by the individual for his own personal consumption. In these days of extensive public supplies, and national water policies, it is obvious that such a method of purification has certainly very limited uses, and that the problem is therefore confined almost entirely to the Services.

As large-scale purification plants have developed due to the increasing tendency of the population to gather together in large cities, so, as the speed of travel increases and the range and mobility of activity of our fighting forces becomes more extensive, must improvements at the individual level continue to be sought.

The realization that purification of water, for drinking purposes for any community, was essential, came towards the end of last century. It is interesting, at the commencement, to see how the supply of water has developed, to trace the knowledge so acquired from the consequent lessening of disease in large communities to its application to smaller groups of mobile forces, and thence to the individual thrown on his own resources, frequently in extremely difficult circumstances. For, as the fear of disease has in the past forced Governments into action, so a Commander in the Field, equally fearing disease as he realizes it can destroy his forces more effectively than any enemy, demands similar protection for his men.

HISTORICAL SUMMARY OF GROWTH OF WATER SUPPLIES

Water is our greatest necessity—water in plenty for drinking, cooking, washing and bathing. As the world developed, each house or cottage had its own water supply, or houses were sited in groups on rivers or lakes so that their demands might be satisfied. Later the need for a communal supply developed as towns grew, until today we find an organization like the London Metropolitan Water Board supplying one-sixth to one-fifth of the population of England and Wales.

The Romans were our first great water undertakers and their aqueducts were a triumph of engineering in many parts of the world. In 1447 we find Hull was granted a Royal Charter by King Henry VI to construct a public water undertaking. A century later in 1585 Sir Francis Drake was instrumental in obtaining Plymouth's first Water Act, and in 1590 he obtained the contract for the works from the Corporation. In 1613 Sir Hugh Myddleton completed London's New River project with the help of funds provided by King James I.

It was not until the nineteenth century that water supplies and disease

became associated. In his surveys for his famous report in 1842 on the sanitary conditions of the Labouring Population of Great Britain, Edwin Chadwick not only noted how badly the greater part of the population were supplied with water, but that what water there was was grossly contaminated by lack of proper drainage and sewage, causing untold illness, debilitation and deaths. These facts were confirmed in the reports for the Health of Towns Commission. Smellie, in his *History of Local Government*, tells us that in 1850 taste was still the method used by inspectors to test the purity of a water supply. However the association of disease with faulty or contaminated water supplies was gaining ground and opinions expressed by doctors were beginning to receive attention.

Dr. William Budd, in 1849, stated that the cause of cholera was an organism of distinct species, passed in air, food and principally water. Again, in 1873, in his classical "*Typhoid Fever*," he maintained that typhoid was conveyed by water, that it was a contagious disease, and that the most virulent part of the disease was conveyed in the discharges of the patient ill with fever.

Dr. John Snow in his investigation of the cholera epidemic of 1854 in the city of London, proved that the disease was conveyed by water obtained from a pump in Broad Street, which had been contaminated by cholera cases in the neighbourhood. A third, Dr. Michael Taylor of Penrith, traced typhoid, scarlet fever and diphtheria to milk. It is astounding to realize that these conclusions were made in the days before the bacterial theory of disease was propounded.

Fear made the Government take action. Sir John Simon was appointed medical officer to the newly constituted Board of Health, and in panic the Sanitary Act of 1866 was passed. As Sir John Simon puts it, "the imperative mood" was adopted in legislation. From this date a duty was placed on Local Authorities to seek out and suppress nuisances.

Progress now became more rapid. The science of bacteriology was developing. Waters that previously had been regarded as eminently suitable were now no longer regarded as safe for human consumption as pathogenic organisms were discovered in them. Taste and appearance, while desirable in every way, could now no longer be regarded as sufficient criteria for the suitability of a water for domestic purposes. Other essentials became obvious. The source of a supply must be free from all contamination and the carriage and distribution must allow of no contamination. (This first point is still being stressed by Sir William Jameson in his annual reports.)

POSITION AT THE END OF LAST CENTURY

We come now to our term purification. Human undertakings always have an element of error. A perfect source is not always obtainable. Rain and floods cause an increase of mud and other organic particles and, in spite of all precautions, dangerous organisms may gain access to our carefully protected water. An additional precaution was obviously required and so the process known as Purification was introduced at the close of the last century.

Two main principles are the basis of this—clarification and sterilization. The first removes the larger particles of organic matter and the latter destroys harmful organisms. In practice a water is considered sterile if a sample of 100 millilitres is free from *B. coli*.

To develop the subject of this dissertation I must turn now from purification in general to a much more particular side, from purification for large groups under static conditions to purification for small mobile groups.

The problem of providing a safe water supply for men in the Field was realized at an early date by the Army. The provision of a pure supply for garrisons and static camps differs in no way from that of a town, but men on the march and under active service conditions present a very different problem. The difficulty of careful selection of a source is considerably increased due to both the shortage of time available, and the understandable desire of any enemy to attempt to deny an advancing column the most suitable sources in the vicinity.

Confusion was increased at this time by differences of opinion of two schools of thought. One held that all water in the Field must be considered dangerous to drink unless it was first purified and the other maintained that water was only dangerous after recent specific contamination.

Brigadier G. S. Parkinson, *C.B.E.*, *D.S.O.*, who served in the South African campaign, recounts comparative absence of facilities for the purification of water supplies.

From a study of the papers available one comes to the conclusion at the time of the South African campaign that purification for mobile Army units was considered rather from the point of view of units on the march. The smallest unit considered capable of purifying water was half a battalion.

The reason for this was the fact that the process of purification was only considered in terms of scaling down larger static plants. Clarification was produced by pumping water through compressed sponge filters and sterilization by passing this water through filter candles of Berkenfeldt and Pasteur Chamberlain patterns. These principles were combined in a water-cart holding 110 gallons. The tank held water after it was clarified by the sponges, and this was not pumped through the candles until the time of actual delivery. This 110 gallons would replenish the water bottles of 440 men if there was no wastage.

Men separated from their water-cart, a highly probable contingency under Service conditions, were thrown back on their water bottles, filled the previous night. The only step taken towards individual purification was a recommendation to boil all drinking water. Boiling requires fuel, dry matches, takes time, leaves the water too hot to drink and perhaps worst of all causes smoke and flame which give away the position to the enemy.

The large number of cases of enteric fever which occurred in this campaign—57,000 cases with 8,000 deaths and an incidence of 100 per 1,000 per annum—indicates the inadequacy of means of obtaining pure water under all conditions.

SOUTH AFRICAN CAMPAIGN TO WORLD WAR I

Many now realize that, in the South African campaign, our methods of supplying drinking water in the Field were inadequate and attention was being paid for the first time to individual methods.

Vaillard in 1902 published a method of purifying small quantities of water for drinking by means of iodine. In his method iodine was liberated in the free state by the interaction of sodium iodate with tartaric acid and then dissolved in an excess of potassium iodide. Vaillard claimed sterilization in ten minutes and the treated water was of normal appearance with no smell or taste. Nesfield, in India, evolved a similar process at about the same time. He had experimented during the South African War with peroxides, nascent hydrogen, sulphuric acid, hydrochloric acid, phosphoric acid, and finally with nascent chlorine. For small quantities of water he experimented with hypochlorite of lime compounded with bicarbonate of soda to form a tablet. This was found too unsatisfactory on account of the instability of the hypochlorite of lime. He then turned to iodine which has a very stable iodide and iodate which readily split into free iodine in the presence of weak acids.

Three tablets were employed, the first containing sodium iodate, and potassium iodide coloured with methylene-blue, the second tartaric acid with a red colouring matter, and the third sodium hyposulphite. Iodine is liberated from the sodium iodate by the tartaric acid and the water is exposed to its action for ten minutes, at the end of this time the sodium hyposulphite is added which exactly combines with the free iodine.

The results were good, but the procedure, simple as it may seem, is rather too complicated for Service conditions. It is obvious that if the tablets were to be used in the wrong order the only result would be a false sense of security which might prove disastrous.

The decade following the South African War was largely spent in trying to perfect physical methods such as heat exchange, and improving filtration methods. Chemical methods of purifying water were regarded by many as visionary, impracticable and incompatible with hostile activities.

Nesfield, however, proceeded with his investigations, and when he accompanied the Tibet expedition in 1904 iodine was used for the purification of the drinking water required. A cholera epidemic was raging in North Bengal at the time but the expedition took 760 Kashmir coolies through the Teesta Valley without the occurrence of a single case of cholera. Other batches of coolies during the same period had deaths from cholera ranging from 2 to 10 per cent of their number. The quantity of iodine used by Nesfield was $\frac{1}{2}$ grain per gallon.

Investigations were also being carried out at the Royal Army Medical College, and at the Army School of Sanitation under Lt.-Col. R. H. Firth and it is interesting to record a demonstration of processes devised for sterilizing drinking water on Field Service given at Millbank Barracks, London on February 10, 1905. Chemical methods featured largely as well as those by filtration and heat.

(1) *Chemical*.—(i) *Bromine* : Schumberg's process devised by Surgeon-General Schumberg of the United States Army. Bromine solution (contained in glass capsules, each holding 2 c.c. = 6 grammes of free bromine, sufficient for 1 litre of water) was added to the water to be sterilized. After standing seven to thirty minutes the bromine was neutralized by adding a mixture of sodium sulphate and sodium carbonate. In about two minutes the odour of the bromine disappeared but a slight stale taste remained.

(ii) *Iodine* : This has already been described. After treatment the water had no smell and was not altered in appearance, while it was difficult to distinguish any difference in taste between natural water and the water thus treated.

(iii) *Chlorine* : The water was treated with bleaching powder and bicarbonate of soda. At the end of ten minutes the free chlorine was neutralized by the addition of sodium sulphite. It was, however, difficult to get rid of the smell and taste of chlorine.

(iv) *Bisulphate of Soda* : First employed by Dr. Samuel Rideal who claimed that 15 grains of bisulphate of soda would sterilize 1 pint of water. An acid taste was imparted to the water, but all the acid could be neutralized by the addition of bicarbonate of soda. A further objection was that the treated water had been found to take up iron from the water bottles.

(v) *Permanganate of Potassium* : Recommended by Dr. Hankin in India. This was added to the water until a faint pink colour becomes permanent. This process was in extensive use in India, but was objected to by the men, partly on account of the colour, and partly because of the slight taste imparted to the water.

(vi) *Copper Sulphate* : This process was still in the experimental stage. The experiments of Dr. George Moore, of the Scientific Staff of the United States Government, appeared to indicate that a solution of copper sulphate, of a strength 1 : 100,000, killed both typhoid and cholera germs at laboratory temperature. From Rideal and Baines' experiments in this country it would appear, however, that 1 : 1,000 copper sulphate killed typhoid and coli in one hour ; 1 : 10,000 killed typhoid but not coli ; and 1 : 100,000 was ineffective. A solution of copper sulphate 1 : 100,000 was tasteless and colourless ; and after it had been allowed to stand no trace of copper could be detected in the water. More interesting still were the experiments which go to show that water kept in a copper vessel was freed from *Bacillus coli* or *Bacillus typhosus* in twenty-four hours. It was thought that, should the experiments be confirmed, their practical application to the wants of the soldier was obvious, and that we had in view a comparatively simple solution of what had hitherto proved a most difficult problem.

(vii) *Alum* : In the proportion of 6 grains to the gallon, alum had long been employed for the purpose of clearing water containing much suspended matter, but, in addition to purifying water by expediting sedimentation, the alum is also germicidal in action.

The following opinion was also expressed. Chemical processes, generally

speaking, are no doubt germicidally effective, but there are many difficulties in the way of their being universally practicable. The processes are largely such as could hardly be entrusted to the individual soldier to carry out ; and the time required for sterilization would be a great bar, when a man is parched with thirst, however well disciplined he may be on other occasions ; while there is also widespread objection among the men to drinking "doctored water."

(2) *Filtration*.—Various patterns of Field Service filters were on view, illustrating its evolution and showing recent improvements. The earliest pattern consisted of a single candle filter in a metal cylinder, mounted on a tripod, with a semi-rotary pump and air vessel. There was no means for preliminary clarification of the water to be filtered, and in consequence the candles became quickly clogged, and the filter soon became unusable. A special clarifying chamber was added, in which cloth straining bags were placed, so that the water was cleared of matter in suspension before it passed to the chamber containing the filter candle. The next important variation was to encase the filter candle in straining bags. This permitted a second candle being placed in the clarifying cylinder, thus doubling the filtering surface without increasing the weight of the filter.

The yield at trials had been 30 to 40 gallons per hour. The yield varied, of course, according to the amount of suspended matter in the water being dealt with.

In the Service water-cart, fitted with Slack and Brownlow filters, the tank of the cart was filled direct from stream or source of supply and no water could be drawn from the cart until it had been passed through the filters.

(3) *Sterilization by Heat*.—Four varieties of heat exchange apparatus were shown.

Dewar, in 1907, in a paper *Sanitation of Armies, in the Field on Active Service*, stated : "No reagent has been discovered which fulfils all the requirements, namely, rapid action as a disinfectant, moderate cost, convenience in use, portability, stability of composition and the leaving of the treated water in such a condition that it is neither unwholesome nor unpalatable." He gave a list of compounds, all of which except one, namely brandy and wine, have already been discussed. These, he said, were slow and unreliable. I find it hard to believe he thought the soldier would load himself with brandy or wine for the sole purpose of purifying suspicious drinking water.

About 1908 it began to be realized that any purification apparatus for Field Service use which depended for its efficiency on earthenware candle would not service the strain. Attention was again directed to the sterilization of water by chemicals, after preliminary clarification. After numerous experiments in the Royal Army Medical College on the sterilization of clarified water by means of active chlorine from chloride of lime, it was ascertained that most well-clarified waters could be rendered innocuous by 1 part of active chlorine per 1,000,000 acting for a minimum period of half an hour. Professor G. Sims Woodhead read a Paper in Cambridge on July 16, 1910, stating that

even large numbers of *B. coli* were rendered inactive by 1 part of free chlorine in 2,000,000 parts of water.

At the same time Colonel Horrocks, later Sir William Horrocks, experimenting with water from Regent's Park Canal and Hampstead ponds came to the conclusion that the main reasons why chlorine had fallen into disfavour were:

(a) That attempts had been made to chlorinate imperfectly clarified water.

(b) In many experiments pathogenic and other bacteria were added in large quantities, and the time of contact had been too short (five to ten minutes), which necessitated large doses of the chemical followed by subsequent treatment to remove the taste.

The earliest work in chlorination had been by German and Austrian medical officers (Traube in 1893, Bassenge in 1895, and Lode in 1895). Lode had discovered the important fact that the amount of chlorine required varied directly with the amount of organic matter present.

Horrocks now turned his attention to the clarification as an essential preliminary to sterilization, as the standard sponge clarifiers were inefficient and failed to prevent rapid blocking of the filter candles. He devised the well-known clarifying cylinder which was used successfully through World War I and in some theatres in World War II.

The cylinder contained a cylindrical reel round which several layers of flannelette were wrapped. Alum was placed in the inlet box; the alum water passed to the outer side of the reel, and a layer of coagulated suspended material was gradually formed on the surface of the flannelette which then acted as an efficient clarifier.

For small detachments a portable "Box clarifier" was designed which consisted of a clarifying cylinder with hose and pumps packed in a special box for issue to small units and messes. Its total weight including the wooden case was 150 lb.

It was hoped to have a Field test in the summer of 1914 but this was prevented by the war.

WORLD WAR—1914 to 1918

In August 1914 it was evident from a survey in Belgium and North-East France that the water in many cases would require clarification and in all cases sterilization. On Colonel Horrock's advice all M.O.s were instructed to use chloride of lime. Suspended matter was first to be removed by alum, 3 grains to the gallon was advised, and the clear water sterilized by the addition of 23 grains of chloride of lime. 4-ounce tins with a spoon holding 23 grains were issued to all units.

The fear that filter candles would not stand up to Service conditions was soon confirmed. In the first week in November 1914 the Army Sanitary Committee visited France and made a careful examination of water-carts in the front-line divisions. They found that all carts depending on filter candles for the sterilization of water had broken down.

By this time it was realized that organic matter in water which had managed

to pass the filters took up the chlorine before it could kill any bacteria present. It was evident that some simple process by which M.O.s could determine the amount of chloride of lime required to render each water supply safe would be a great help. This help was soon given.

Professor G. Sims Woodhead of Cambridge, published a Paper on September 19, 1914, on the sterilization of water supplies for troops on Active Service. In this paper he stated : " I satisfied myself that if particulate matter could be removed from a water by means of any of the ordinary filters it was possible to render even a highly polluted water perfectly safe for drinking purposes by the addition of appropriate amounts of chlorine, and that these appropriate amounts could be determined by the starch and iodine test." He devised a simple test which when slightly modified by Colonel Horrocks was admirably suited for Field Service. The Horrocks Box, almost in its original form, is still in use in the British Army and has no rival for the purpose for which it was designed.

An analysis at the Royal Army Medical College of the contents of tins of chloride of lime showed that on an average the available chlorine in each tin was 33 per cent.

Horrocks and Woodhead showed when an emulsion of 2 grammes of this powder in 250 c.c. of water was made, that $1/15$ c.c. of this emulsion when added to 187 c.c. of water liberated 1 part per million of free chlorine.

They also demonstrated that 2 grammes of this chloride of lime, when added to 110 gallons of water, the capacity of a water-cart, produced approximately the same amount of free chlorine.

Based on these facts the Field Test Case devised by Horrocks contained a standard scoop holding exactly 2 grammes of powder, one cup holding 250 c.c. for the emulsion and six cups each holding 187 c.c. for the estimation of the absorption of chlorine. Pipettes were included which, when held vertically, delivered exactly $1/15$ c.c. of the emulsion. A bottle of starch iodine indicator solution comprised the complete box.

Small parties of men could now be guaranteed pure water from any source. Unfortunately the apparatus required was much too heavy unless some form of transport was available consisting as it did of a clarifier, a pump, two canvas tanks, a test box, a supply of alum and a stable chloride of lime. The total weight was about 200 lb.

It was decided also, in August 1914, to issue tablets of acid sodium sulphate (Rideal and Parkes, 1901) for small parties of cavalry, who it was thought might easily get separated from their units. Each tablet contained 16 grains of anhydrous sodium bisulphate and $\frac{1}{4}$ minim of oil of lemon. They were issued for emergency use only as they had several drawbacks. Being a powerful metal solvent they acted on water bottles made of enamelled iron if they were chipped forming ferrous sulphate which has a bad taste and colours the water. A very objectionable taste occurred on prolonged contact with aluminium. and if exposed to a moist atmosphere acid was liberated which burnt both clothing and skin.

Soldiers were instructed to dissolve one tablet in each half-pint of water used and to allow the water to stand half an hour before drinking. Half an hour is too long to expect parched men in advanced positions to wait.

Just as things seemed to be nicely settled, Nesfield, this time in Mesopotamia, reported in June 1916 that chloride of lime was unreliable as it was completely unstable in hot climates. He maintained that the only possible chlorine compound was sodium hypochlorite which kept its potency for twelve months or more in India. This difficulty was not overcome until 1918 when Nettie, Smith and Richie discovered that the addition of quicklime to bleaching powder considerably improved its keeping qualities and, after further investigations by Aumonier and Elliott, a mixture of four-fifths bleaching powder and one-fifth quicklime was adopted by the British Army under the name of water sterilizing powder.

This mixture reduces the amount of available chlorine slightly but its keeping qualities are so improved that it should not fall below 22.5 per cent in one year.

Trouble also came from another quarter. The number of cases of schistosomiasis in Egypt and Palestine was causing great concern. Prevention was difficult as little was known of this most debilitating disease, so a mission was sent to Egypt in February 1915 under Dr. R. T. Leiper, assisted by Dr. R. P. Cockin and Dr. J. G. Thompson. They returned to England in July 1915, having established the definite life-history of the parasite and shown that storage of screened water—screening 16 meshes to the linear inch—for forty-eight hours was an effective precaution. This was very satisfactory but unfortunately their investigation showed that chlorination as ordinarily practised for drinking water did not suffice to destroy the cercariæ which might even pass through the filters. In a solution containing 1 part available chlorine in 100,000 they were alive and active after one and a half hours. Sodium bisulphate 1 : 1,000 killed them almost immediately.

In May 1917 a further advance came. W. H. D. Dakin and Major E. K. Dunham of the U.S. Army Medical Service after experimenting with several compounds came to the conclusion that p-sulphondichloramino benzoic acid, or Halazen, was the most suitable for individual use. A concentration of 1 : 300,000 was sufficient to sterilize heavily contaminated water in thirty minutes. It was more stable than chloramine T and when kept in amber bottles under ordinary conditions no decomposition was noted in two months. When exposed to bright sunlight in clear glass bottles decomposition occurred.

Toluene-sulphondichloramines were found to be unsuitable due to the fact that in the tablet form they were almost insoluble and that the rate of decomposition increased rapidly when mixed with sodium chloride to form tablets.

Halazen tablets were issued for the sterilization of small quantities of water such as are needed by cavalry. The reports as to the sterilizing action were on the whole favourable, but some doubts were expressed as to its maintaining its efficiency under Active Service conditions, especially in the tropics.

1918 ONWARDS

No further advances were made until Harold began developing the process of chloramination. This, however, is suitable for large-scale purification and apart from mentioning the ingenious mobile water purifier devised by Elliott which is capable of filtering and purifying 3,000 gallons per hour using ammonium sulphate and chlorine generated by electrolysis from brine, further description does not come within the scope of this paper. The whole apparatus is mounted on a 30 cwt. chassis. It is, therefore, mobile but restricted by its weight to tracks negotiable by heavy transport.

In summing up the position in 1923 Lt.-Col. J. A. Anderson calls attention to the fact that apart from the tablets of sodium bisulphate of Rideal and Parkes which have many disadvantages, no standard arrangements for small detached parties existed. Lelean had devised a method of adding chlorine to water bottles and small water containers like pakhals. It was ingenious but, again, although it was adaptable for small parties, it required time and at least one member of the party skilled in using the Horrocks Test Box. The number of scoopfuls of W.S.P. required to leave one part per million of the free chlorine in 100 gallons must first be determined by using the Horrocks Box. This amount is added to the contents of one water bottle to form a strong solution; one scoopful of this solution when added to another water bottle will give a solution containing one part of free chlorine per million. It is an excellent method and I have had many an occasion to use it when out on a column, but it is not suitable for individual use.

One of the objections to chlorination is the taste remaining in the water after treatment. This may be chlorinous or one described as a "chemist's shop" taste due to the formation of iodoform if any phenols are present in the water. It was discovered in 1938 by Mackenzie that this taste could be got rid of by over-chlorinating followed by the removal of the excess chlorine by the addition of sodium thiosulphate. This is known as superchlorination.

Its advantages over simple chlorination are many. The contact time is lessened from thirty minutes to fifteen minutes. The deviation of chlorine by any organic matter is of the less importance. Underdosing is less liable to occur. All taste of chlorine is removed immediately on adding the thiosulphate and any phenol taste is removed.

To superchlorinate, W.S.P. is added in sufficient doses to give 2 parts of free chlorine per million after deviation by organic matter has taken place. The Horrocks Test indicates the amount necessary to give 1 part per million; consequently to give 2 parts per million one extra scoop will be required per 100 gallons.

This amount of free chlorine will kill all pathogenic organisms in fifteen minutes or less.

Dechlorination is carried out by the addition of sodium thiosulphate at the end of fifteen minutes—1 gramme per 100 gallons. The anhydrous salt which contains half of its water of crystallization is used as it is very stable. The

crystalline salt melts at a temperature of 118° F. and would be useless in the tropics.

Using this method Colonel E. F. W. Mackenzie developed a modification of Lelean's water-bottle method where no Horrocks Box is available. He decided on a fixed dose of 4 parts per million and advocated a period of thirty minutes' contact followed by dechlorination. Using this massive dose there is no need to allow for compensation for loss of chlorine due either to excessive deviation or deterioration of the W.S.P. The long contact time of thirty minutes was designed to allow penetration of particulate matter where filtration had been impracticable. Colonel Mackenzie shows that his test was evolved from practical experience by adding that it is highly improbable that thirsty men will wait the full time. This heavy dose, he claims, will, in five minutes, purify a grossly polluted water under severe conditions of temperature and pH values.

Following these lines, the halazone method of individual purification introduced by Dakin and Dunham was developed. The underlying principle again being superchlorination to a high degree followed by dechlorination. Being an individual method no Horrocks Test would be available and therefore no estimate of the amount of chlorine necessary for sterilization could be made.

A compact outfit was made consisting of a tin box, 2 in. by 2 in. by $\frac{3}{4}$ in., containing two small bottles. The first holds the sterilizing tablets each containing 3 grains of a mixture of halazone 7.5 per cent, anhydrous sodium carbonate 10.5 per cent, and anhydrous sodium chloride 82 per cent. They are white in colour and stable under hot dry climates but deteriorate rapidly when exposed to a humid atmosphere. One tablet liberates 4 to 7 parts per million of free chlorine in a water bottle of water. The second contains the dechlorinating tablets each containing $1\frac{1}{2}$ grains of a mixture of sodium chloride 85 per cent, and anhydrous sodium thiosulphate 15 per cent. These tablets are blue in colour. Directions for use are printed inside the lid of the box. The bottles have cork stoppers, not composition corks which disintegrate, and they are sealed with plastic wax which sticks to glass and metal.

These individual outfits were issued freely during the last war. They are, however, not ideal. The chief fault is that the white or chlorinating tablet is extremely difficult to dissolve unless it is crushed against the neck of the water bottle first. This is much easier said than done, as the present water bottle has a very narrow neck and the tablet either slips into the bottle intact and refuses to dissolve, or shoots behind the now desperately thirsty individual into the jungle and is lost for ever. Having accomplished this tricky manoeuvre and waited patiently for the prescribed time of fifteen minutes, another trial awaits our now dehydrated soldier. He uncorks his bottle of blue tablets, to detaste, and attempts to shake one into his hand. Nothing happens. He inserts a twig to loosen one, and a sticky mass of indeterminate amount emerges attached to its tip. Two things may now happen, one, the twig and blue mass are inserted into the water bottle and if the stick is contaminated

so also is the resultant water, the other, twig and bottle containing the blue mass are thrown away and the strong chlorine solution consumed, with no ill-effects except that the soldier will probably never use the white tablets again. In a few days the tin and bottle of white pills will follow its blue companion into the jungle.

These comments may seem rather harsh, for on the whole the halazone method of individual purification gives good results under most conditions, but in battle for superiority, like many other excellent pieces of Service equipment, tropical jungle comes out the winner.

During the inter-war period experiments were carried out to improve the portable clarifying apparatus. The cloth reel filter designed by Horrocks was efficient provided it received careful maintenance. This included scrubbing and washing of the special cloth for the reel. Considering how sheets are returned from modern laundries, it was amazing how long clothes lasted, but sooner or later a hole would appear which might render the filter useless unless a spare cloth were available. A second point was at the joining of the spigot at the end of the reel which was made watertight by a rubber ring. Any leakage at this point and unclarified water passed directly into the tank. Lastly if the water concerned was very full of sediment the cloth might become so heavily coated that it would be impossible to force more water through it. This meant dismantling and cleaning the filter before it could be used again.

The result of much research was the design of compact pressure filters of two types, the Meta and Stellar, which differ in construction only slightly.

Each filter consists of a cylindrical metal chamber surmounted by a movable metal head to which is fixed a "core" composed of a number of flat non-corroding metal rings and washers, slightly embossed on one side, which are strung over a fluted rod and secured by pressure from the ends. The rings are of two sizes, every sixth ring being larger than its neighbours; these serve to support the filter bed and a wire gauze sleeve. The space between the rings is $\frac{1}{3,000}$ th inch.

The Stellar filter has a core of monel wire wound round a brass former. The space again between the spirals of the wire is $\frac{1}{3,000}$ th inch.

The filter medium consists of a charge of specially prepared Kieselguhr coated with silver and mixed with aluminium hydrate. This forms a bed over the whole surface of the core on pumping. Water passing through it is rendered free from suspended matter and substantially free from bacteria. Both cysts of *Entamoeba histolytica* and cercariæ are retained by the filter.

After use for some time the filter may clog. This can be freed immediately by back flushing and then reforming the bed in the usual way.

The filters are mounted in pairs on the water-cart so that one can be used to clean the other. Each filter head holds four cores or six to increase the speed of filtering. The candles have a filtering area of one square foot and, combined, have a capacity for dealing with 200 gallons of water per hour.

A portable filter for use with detached parties has also been designed. This has a capacity of 100 gallons per hour, which means it will fill 200 water

bottles in half an hour. This filter complete with hand pump and tripod mounting can be packed into two panniers of approximately 90 lb. each, and can be carried in light transport or by mules.

A midget Meta filter with a capacity of 20 to 30 gallons per hour weighing 14 lb. for even smaller parties has also been produced.

If pumping is stopped for any reason, the bed may break off the candle, resulting in the first quart of water being turbid on repumping. Investigation is being carried out at present at the Army School of Hygiene by Major Carrick to overcome this difficulty.

Kieselguhr is a white gritty powder, pure silica (Si O_2), made up of the skeletons of diatoms. It is dug out of the earth, ignited to destroy organic matter and then air-blown to grade it into various sizes. The coarsest of the eight varieties gives a high rate of flow—1,000 gallons per square foot per hour, but will not filter clay out of water. The finest variety yields about 40 gallons per square foot per hour and gives a very good filtrate. The Service variety is intermediate yielding about 200 gallons and efficiently filtering clay, cysts and ova.

Kieselguhr is completely insoluble in, and does not alter the composition of, water. Powdered coal is a good substitute but only yields 100 gallons per square foot per hour.

A new type of candle for pressure filters has been produced by Sintered Products Ltd. This candle is made of porous gun metal. It is half the weight of the Stellar or Meta filters, takes half the amount of Kieselguhr and back-washes more easily.

It has not yet been accepted as a standard Army type.

With the advent of paratroops came the urgent necessity for making individual methods absolutely safe and reliable for general use and not merely as a temporary measure. In the Burma campaign there was no question of infantry and transport following up initial paratroop landings in a matter of twenty-four or forty-eight hours. It was also realized that conditions, in many cases, compel the soldier to make use of water so dirty that even if all the available chlorine liberated by a halazone tablet was not deviated before killing any bacteria present, the resulting fluid would be unpotable. Some type of suitable filter had to be devised. It was obvious that it would have to be light, small, compact and extremely simple to use. Clearly no adaptation of the pressure filter would be of any use, as its weight, bulk and supplies of Kieselguhr were out of the question for such type of fighting.

The answer was discovered by Major Stanley Elliott and Major Hall who produced the Millbank Filter Bag. This consists simply of a "chain weave" light canvas bag approximately 4 in. across and 12 in. deep, one side being slightly longer than the other. To use it the bag must be thoroughly wet first, then filled with water and hung up on a stick.

The first half to one pint is allowed to run to waste, after which the water is clear and water bottles can be filled. The bag must not be touched while it is filtering.

Cleaning it is equally simple. It is turned inside-out and either back-flushed with clean water, or the mud is washed off and the bag is allowed to dry.

This chain-weave bag removes clay, cysts, ova and cercariæ from any water. Sterilization can then be carried out by halazone tablets giving a safe potable drinking water from any source.

The bag when not in use is rolled up and put in a little waterproof wallet a few inches square. The total weight is about one ounce.

It has always been felt that a two tablet or multiple system of purification has the disadvantage that, under the stress of battle, the tablets might easily be used in the wrong order, or that only one might be used and the other neglected resulting in either case in an unpurified water.

To overcome this, and also the disadvantage of chlorine, which is liable to be deviated, lacks persistence and penetrating power, produces an objectionable taste and whose action is delayed by highly alkaline water or waters containing ammonia, the use of iodine was again investigated. Two products were made in America in 1944. Bursoline (diglycine hydriodide phosphate) and Globaline (triglycine hydriodate phosphate).

These compounds are not yet available in this country, but it is claimed that one tablet of 0.112 gramme will yield 7 parts per million of iodine in one quart of water. All pathogenic bacteria are said to be killed in ten minutes. Cysts and cercariæ are also claimed to be killed.

If these claims are substantiated these will undoubtedly be valuable products for Service conditions.

The possibility of using Catadyn units of specially prepared silvered beads or sand in water bottles has not been considered on account of the expense and the time required for sterilization. Although contact of the water with the units for a few minutes only is necessary the water must then stand for two hours for the germicidal action to be completed.

RECENT ADVANCES IN CHLORINATION

Atomic Age

Impure waters containing salts of calcium, sodium, sulphur, nitrates and iron may remain radio-active for long periods unless considerable dilution can take place. As water from a radio-active source is unfit for use, a form of easily portable detector will have to be relied on as a safeguard. For Service conditions it is obvious that such a detector will have to be compact, light and strong and of such a size that it can be easily carried and used by one man.

Major Booker has designed such an instrument, but it has not been accepted yet for Service use.

Recent work shows that there are five interdependent variables affecting the speed and efficiency of chlorination:

(1) Concentration of organisms—with a heavy contamination a large dose of chlorine is needed.

(2) Heavy dose of chlorine—much quicker and safer.

(3) Concentration of ammonia—if much is present and the Cl/NH_3 ratio approaches 1/1 the process is slowed up—risk if heavy sewage contamination.

(4) pH values—the more acid the water the quicker the action.

(5) Temperature—the higher the temperature the quicker the action. At 2° C. 1 p.p.m. works in the normal way unless retarded by ammonia. This is important under Arctic and sub-Arctic conditions.

Cercariæ and E.H. cysts—recent work by Chang and Fair in America shows that all the above five factors are concerned. 1 part per million of free chlorine will kill 100 cysts per cubic centimetre in half an hour at 20° C. provided no ammonia is present and the pH value is 7.4. Any departure will cause failure.

Leptospira icterohæmorrhagiæ are less resistant than coli.

Poliomyelitis virus in water was inactivated in ten minutes at a pH of 6.8 to 7.4 with the temperature varying between 20 to 30° C. by 0.05 part per million of free chlorine. When the pH value was over 8.5 the virus was sometimes unaltered. $\frac{1}{2}$ to $\frac{3}{4}$ p.p.m. of chlorine was effective at all pH values in less than two hours. 0.2 p.p.m. of chloramine was not effective.

METHODS USED BY OTHER ARMIES

A short comparison of progress made by other countries is interesting. As mentioned earlier Vaillard introduced the iodine method of individual purification in 1902 in France about the same time as Nesfield but no attempt seems to have been made to follow it up and adopt it for Field Service. Professor Testi devised a modification of the American Schumberg's bromine method for the Italian Army in 1909 but this also died a natural death.

In 1910 Regimentsarzt Dr. Galser published a paper on the purification of drinking water for the individual soldier. He advised the use of calcium permanganate followed by magnesium sulphate. This method had a great disadvantage in that tablets of these compounds were insoluble and concentrated solutions were required. No more came of this method and in July 1912 the Berlin/Neueste Nachrichten stated that the next German Army Budget would include a sum for the provision of sterilizers for drinking water for Medical Store Depots on Lines of Communication. The method of sterilization was by heat and no further particulars were given.

In the last war the Japanese used an apparatus containing filter candles. It was complicated and neither portable nor efficient. The water to be sterilized was pumped by a semi-rotary pump into a chamber containing six large candles, grouped round a central brush. The candles were about 3 inches in diameter and 2 feet long. In theory if the candles started to clog and the pressure on the pump increased, by turning a crank handle the candles not only revolved round the central brush, but also turned in their seating and so all the clogging matter was removed and washed into a sump drained by a tap.

The whole apparatus complete with hoses and floats was contained in a chest approximately 3 ft. by 2 ft. by 2 ft., fitted with telescoping handles and weighed about 3 cwt.

In practice the rotary pumps were insufficient and could only lift water about 2 ft. This meant that the contraption had to be built into the river bank and if heavy rain occurred during the night and the river rose, it was almost suicidal struggling up a steep river bank in the dark with this appalling weight.

Sometimes with great care this rather temperamental object might yield water, but although we were assured many times a day that the resulting fluid was absolutely sterile, the "effluent" was always very carefully boiled by the Japanese before consumption in spite of the fact that if we were found following suit it was considered a deadly insult to the Emperor in doubting the efficiency of any of his Armies' equipment. However, even the Japanese, who carry more junk around with them than any other Army, abandoned these "gifts" of the Emperor in the jungle.

IN CONCLUSION

An attempt has been made in this paper to show that in putting an Army in the Field, as much care and attention must be paid to providing the individual soldier with the means of protecting himself from drinking impure water, as is paid in training and equipping him to fight an enemy. A sick soldier cannot only not fight but is a heavy burden on his comrades.

The ideal method must be simple, and not a series of processes. Any material required must be light and compact as the burden of the fighting soldier must be reduced to a minimum. It must also be durable to withstand all conditions in all weathers and climates from Tropical to Arctic. Similarly any chemicals used must be stable under these conditions for considerable periods.

An improved water bottle with a wider mouth, screw stopper and detachable cap has been used on field trials. This embodies many improvements but has been found to have several disadvantages.

As detection of poisons in water is still the province of the chemist or the doctor no mention of it has been made. Advanced troops are still at the mercy of their own discretion.

The advent of the Atomic Era has presented new problems with added dangers which must be solved.

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THE INCAPACITATED SOLDIER IN THE SIXTEENTH CENTURY

BY

DAVID STEWART

IN an earlier paper we have seen that up to the middle of the sixteenth century the sick and wounded in war received but little attention from the Government. This statement applies equally to those who were totally incapacitated in the service of their country. Once an unfit man arrived in England the Government took but little further interest in him ; and it was up to himself to find his own way home and to sustain himself as best he could.

Till the time of the Reformation many of the incapacitated must have been looked after by the various religious establishments and charitable institutions, which were then so numerous in this country. But when, in the reign of Henry VIII, the monasteries and other religious charitable houses were closed down, the disabled soldier, like many other poor people, was badly hit. He had lost his only means of honourable existence, and the only courses left open to him were, if he were not to starve, begging and crime.

This parlous state of the incapacitated soldier became very obvious to the community during the reign of Elizabeth. For the first time, since the closure of the monasteries, England became actively involved in wars on the Continent, with the result that the numbers of incapacitated soldiers in the country increased very greatly. Also, on account of the greater interest that was being taken in the care of the sick and wounded, large numbers of these men were brought from the Continent to London to receive treatment in the only two large and adequately staffed hospitals, namely St. Bartholomew's and St. Thomas's. Many of these men, after treatment in hospital, were found to be unfit for further service and were then discharged from the Army. Having no money to enable them to get to their homes, they had to remain in London, and that town, by the 'eighties of the sixteenth century, had a large number of these incapacitated men roaming its streets, supporting themselves as best they could, by begging, and even at times resorting to crime and violence. It became obvious, if only to prevent talk and public scandal, that something had to be done for these disabled fellows.

The Privy Council took action, and on November 20, 1586, called upon the Lord Mayor of London and the Justices of the Peace of Middlesex to examine all disabled people who were begging in the streets, and to find out which of them had received their injuries in the Queen's wars, and which of them were imposters. The former were to be relieved and sent back to their own counties

with letters recommending them to the care of the authorities there. The latter were to be arrested and severely punished. To raise the money to enable the civic authorities to relieve these men, the Privy Council wrote to the Bishop of London, and requested him to order all clergymen, who were appointed to preach at St. Paul's Cross and other places in the city, to bring to the notice of their congregations the distressed condition of these unfortunate ex-soldiers, and to take collections on their behalf (*A.P.C.*, 1586-7, p. 253).

At first sight it might seem that this business of appealing to the charitable for money was an attempt by the authorities to pass on their obligations to other people. But there is much to be said in justification of the action of the Privy Council. It does not appear that there was, at that time, any legal obligation upon the Queen or her ministers to do anything for these men. Furthermore, however much they may have sympathized with those incapacitated in the service of the country, the Government officials had few means at their disposal to relieve them. The amount of money at the disposal of Elizabeth was very small, and there was little to spare for unforeseen contingencies such as this. Elizabeth has often been accused of being parsimonious, particularly in her treatment of the armed forces, and it has been said, not without reason, that she cut down their cost to such an extent that she impaired their efficiency. The answer to this criticism is that she had to be parsimonious because she had little money to spare for these things and that, whenever she exceeded her income, she had to go cap in hand to parliament and ask for more. It is true that her parliaments were fairly subservient and, so long as subservience did not touch their pockets, they generally did what she wanted. But the good Queen understood quite clearly that if she started to ask for money parliament might very quickly become difficult.

This lack of money had a powerful influence upon the central government in shaping its policy for the disposal of disabled sailors and soldiers. No doubt the Privy Council could have devised a satisfactory system of pensions for these men, run by some central board under its direction. But, unfortunately, the Council had no money at its disposal for this purpose. Therefore some other plan had to be evolved.

As a long-term policy the raising of money by appealing to the charitable is unsatisfactory. On one or two occasions the money may be obtained, but the public quickly becomes tired of repeated calls upon its purse, and soon cease to subscribe. However, as a stop-gap this method is often very successful, and it appears to have been so at this time. London was relieved of a great number of importunate wretches, by their being packed off to their homes in the counties, and no further complaints under this head were heard of for several years.

Some six years later, the matter once again became serious, and on February 28, 1592, it again became necessary for the Privy Council to take action. This time they appointed a number of examiners, who were instructed to call before them all soldiers and sailors who were in London. They were to interrogate them as to where they had served, whether they had any sort of passport from their

commanding officer, and whether they had ever been wounded in the Queen's service. Having obtained this information, the examiners were to dispose of the men in the following manner. The fit men with satisfactory passports—presumably some form of discharge papers—were to be sent back to the counties from which they had been pressed. Those who were without documents were to be treated as rogues and sent to gaol. The men who had been wounded, and whose wounds required further treatment, were to be passed on to the governors of the London hospitals for admission to those institutions, to be retained there until they had been cured. The names of the totally disabled were to be forwarded to the Privy Council with details as to the place and time when they had been wounded (*A.P.C.*, 1591–2, pp. 295–6).

The examiners did their work expeditiously, and, a fortnight later, the Privy Council were able to issue further instructions to them to consider what grants of money should be given to the incapacitated men to enable them to return to their homes. At the same time the Privy Council issued orders to the Lord Mayor of London to pay these grants to the men concerned. When this had been done, the examiners were to issue passports to the invalids to enable them to return to their own counties and at the same time they were to warn them that, if they were afterwards found in London, they would be dealt with severely (*A.P.C.*, 1591–2, p. 335).

One may ask where was the Lord Mayor going to find the money to meet this demand? What had happened was that the Privy Council had discovered that there was a sum of £120 in his hands, which had been accumulated from fees paid by the London butchers for licences to kill cattle and sell beef during Lent. The Government was so short of money that any source from which it could be obtained was utilized (*A.P.C.*, 1591–2, p. 335).

It must, however, have been quite clear to those in authority that such hand-to-mouth methods were quite inadequate for dealing with the problem of the disabled soldier. It might have been possible, by using these casual sources, to obtain sufficient money to get the disabled soldiers out of London and back to their own counties; but what was going to happen to them when they arrived there? There was no law to compel the county officials to do anything for these helpless fellows, and the Government could only hope that their own counties would feel charitably disposed to them. This problem must have been foreseen by the Government, because they took the matter up with parliament—the only body who had the power to raise the money required—and that assembly in 1593 passed an Act, 35 *Elizabeth*, chap. 4, empowering county authorities to raise money for the maintenance of totally disabled seamen and soldiers, who had received their injuries after March 25, 1588.

This Act provided for the levying of local rates upon the different parishes of the kingdom. The amount to be paid by the individual parishes in any county was to be decided by the Justices of the Peace of that county assembled in Quarter Sessions, and the meeting for this purpose had to be called within two months of the end of the session of Parliament in which the Act was passed.

No parish was to be rated at higher than sixpence a week and none less than a penny. If there were more than fifty parishes in a county the average rate for the county was not to be more than twopence per week per parish.

The parish rate was to be collected by the churchwardens of the parish, and handed over by them to the High Constable of the division of the county to which the parish belonged. The High Constable passed whatever he received to one or other of the two treasurers appointed by the justices for this purpose.

The treasurers were appointed for a year, and at the end of their period of office they had to submit to the justices accounts of their receipts and disbursements.

Penalties were laid down for the punishment of any of the above-mentioned officers who failed to carry out the duties imposed upon them by this Act. The churchwardens could be fined up to ten shillings; the high constables forty shillings; and the treasurers could be mulcted at the discretion of the Justices of the Peace.

There were regulations for the disposal of the disabled soldier. Whenever such a man arrived in England: if a pressed man, he was to return to the county from which he had been conscripted; if he was a volunteer, he had the choice of returning either to the county in which he enlisted or to the one in which he had been born. Each disabled man had to bring with him a certificate from the general or admiral under whom he had served, or from their authorized deputies, that had to contain details of his service and of his injuries. In order to prevent fraud, one of the first things the invalid had to do, on his arrival in this country, was to get this document approved either by the receiver-general of the muster rolls or by the controller of the Navy. As these officials were usually located in London, this meant that he had to go to the capital before he could set out for his own county. When the man ultimately arrived at his destination, he reported himself to the county treasurers and presented to them his certificate duly approved by the receiver-general or the controller. The treasurers then decided what temporary relief they should give him to keep him going until the next meeting of the quarter sessions. In determining the amount of this relief, they had to take into account his rank, length of service, and the nature of his disability.

At the first quarter sessions after the man's return to his county, the justices allotted him a permanent pension, and the county treasurer continued to pay him this quarterly, until the Justices of the Peace, in Quarter Sessions, revoked their earlier decision.

The maximum pensions allowed under this Act were ten pounds per annum for a private, fifteen pounds for an officer under the rank of a lieutenant, and twenty pounds for a lieutenant.

As the disabled man, when he returned to this country, had first of all to proceed to London and then go on to his own county, it was necessary to give him an allowance so that he could maintain himself during these journeys. To provide this, the treasurer of the county in which he landed was permitted to give him sufficient money to carry him on to the next county, where the

next treasurer was to do likewise, and so on from county to county until he reached his destination.

Any disabled pensioner found begging was to forfeit his pension, and was to be treated as a rogue or a vagabond.

Corporate towns were authorized to run their own pension schemes independently of the county in which they were situated.

This important Act introduced the first scheme ever devised in this country for the maintenance of the incapacitated soldier. With certain amendments it remained in operation until the time of the Civil War, when it finally broke down under the peculiar circumstances of that time. In practice this Act was only moderately satisfactory, as it depended for its success on the zeal of the local county authorities. If these men did not do their duty the scheme broke down in that county, and the invalid ex-soldiers became greatly distressed.

The weak points in the Act soon became apparent to those whom it was designed to benefit, and a number of ex-Servicemen petitioned the House of Commons to give them relief. They complained that they could not obtain their pensions, because the high constables refused to collect, from the parishes, the money to provide them. Also, despite the clause in the Act forbidding this practice, many of the pensioners were begging, and were taking away the only means of livelihood of those disabled soldiers who were not entitled to benefit under the Act—those who had been wounded before March 25, 1588. Finally the petitioners asked that the moneys collected in the counties should be paid into the exchequer, and that the payment of the pensions should be undertaken by the central government (*Salisbury, iv, p. 457*).

In regard to these complaints, there is no doubt that many of the pensioners had difficulty in obtaining the full amount of the pensions that they had been awarded. This was not due entirely to slackness or dishonesty on the part of the county officials. The fundamental trouble was that the amounts raised from the assessments of the parishes were insufficient to meet the cost of the scheme, and many of the pensioners could only be paid a small proportion of the pension which they had been awarded. This fact was probably the cause of pensioners becoming beggars, and taking the risk of being classed as rogues and vagabonds. The final suggestion that the pensions fund should be administered centrally received the blessing of several later writers, who considered that the Queen and her advisers acted dishonourably, and avoided carrying out their obligations to the wounded soldier by passing them on to the county authorities. But we have already mentioned that the Queen had no money available for this purpose and had to go to parliament to obtain it. It was parliament who decided how the money was to be raised, and it was parliament who ordered that this business should be administered by the counties. And as the members of parliament at this time were also the county magnates, they took over this important duty of their own free will. Therefore it was parliament, and not the Queen, that was responsible for the decentralization of the payment of pensions, and they are the people to be censured for this, if censure is necessary, and not the Queen.

It is not difficult to understand why parliament acted as it did. If the members had decided to let the central government run the scheme, they would have had to provide it with funds by means of taxes. Parliament, however loyal it might have been to the Queen, was loath to give her or her Government more money than was absolutely necessary for the running of the country. It therefore preferred to keep the administration of the scheme in the hands of its own members, who, when they returned to their own counties, became the Justices of the Peace who decided how the pensions were to be paid. And can we say that they were wrong? With communications as they were at that time, it would have been almost impossible to have administered these pensions from a central fund. In those days there was nothing corresponding to the modern elaborate post office system, and the difficulties of distributing pensions all over the country would have been insurmountable. It would have been necessary for the pensioners to have lived in London, or very near to it, and that was exactly what everybody wanted to avoid. The Act of 1593 got the incapacitated men out of the capital and sent them back to their own counties and parishes, where they were known, and where any fraud or impersonation could be immediately detected.

Once the Act was passed, no pains were spared by the Government to get it put into force, and to get the mass of maimed men moved out of the metropolis. As some time had to elapse between the date of the passing of the Act and of its coming into force, money had to be found to maintain these incapacitated fellows, and also to defray their expenses during their journeys to their homes. This money was raised by means of a compulsory collection from members of both houses of Parliament (*C.S.P.D.*, 1591-4, p. 340).

A committee of fourteen, under the chairmanship of Sir Robert Sidney, was ordered to meet at the Sessions Hall at Newgate, on April 4, 1593, to examine all disabled soldiers as should appear before them. These men had to produce evidence that they had been incapacitated, within the last four years, in Her Majesty's service. Those who were able to substantiate their claims had their names entered in a register with details of the county in which they had been enlisted or where they had been born. The time and place where they were wounded, and the names of their commanding officers were also noted; and a record was also made of whether they had already received a grant on account of their wounds, or had been appointed to a beadman's place in an almshouse. The committees were urged to finish their work as quickly as possible, and in order to expedite their enquiries, it was suggested that they should divide up into sub-committees. As soon as they had completed their work they were instructed to send their registers to the Lord Keeper (*C.S.P.D.*, 1591-4, p. 340).

When the Lord Keeper received the registers the Privy Council took action. They arranged that every man should be given a travelling allowance to his home at the rate of a penny a mile; and if he was very lame, and would take longer on his journey, he was given twopence a mile. They drew up nominal rolls of the men according to the counties to which they belonged, and sent

these to the Lord Lieutenants. With these rolls were included sufficient sums of money to allow the Lord Lieutenant, or his deputies, to pay each pensioner in his county two shillings a week until the appointed day for the meeting of the Justices of the Peace in Quarter Sessions, who would then fix the final pensions of the invalids.

At the beginning of June, when the appointed day arrived, the Privy Council wrote to all the Sheriffs and Justices of the Peace throughout the Kingdom, and drew their attention to their duties under this Act, and urged them to carry them out properly (*A.P.C.*, 1592-3, pp. 298-300).

After several years' experience of the working of the Act many of its weaknesses became apparent, and an opportunity was taken in 1597 to improve it by passing an amending Act (39 *Elizabeth*, chap. 21). It had soon been discovered that the assessments that were levied on the parishes were insufficient to meet the cost of the pensions, and they were now raised to a maximum of eightpence and a minimum of twopence per week per parish. In counties with more than fifty parishes the average rate per parish was increased to fourpence. Special arrangements were made for the City of London, where there had been heavy calls upon the pensions fund. The Lord Mayor, the Recorder and the Aldermen were empowered to rate individual parishes as high as two shillings per week, with the limitation that the average for the whole of London had not to work out at more than eightpence for each of the parishes in that city.

The Justices of the Peace of a county were now allowed to appoint treasurers who were not Justices of the Peace ; and they were also empowered to revoke or alter the size of any pension whenever they thought fit. The penalty for churchwardens not performing their duties properly was increased from ten shillings to one pound.

In 1601 further amendments were made by 43 *Elizabeth*, chap. 3. The parish assessments were once more raised and the maximum now became tenpence : no alteration was made in the minimum assessment. The average rate per parish in counties with more than fifty parishes was increased to sixpence. In London the maximum was raised to three shillings, and the average for all the parishes of that city became one shilling.

The petty constables now shared with the churchwardens the responsibility for collecting the rates of their parishes.

The incapacitated man had to supply himself with a certificate from his company commander as well as from the general under whom he had served.

The county treasurers had now to give their reasons for refusing to give a man a temporary pension when he produced the proper papers.

With these various amendments this pensions scheme would probably have worked reasonably satisfactorily if the county authorities had been prepared to do their duty. But this they were not all willing to do ; and in many cases they tried to avoid their obligations by passing the responsibility for relieving incapacitated soldiers on to some other county. A county in which a man had been enlisted would pass him on to the county in which he had previously resided ; and the county in which a man had previously resided would pass

him to the county in which he was enlisted (*C.S.P.D.*, 1591-4, p. 342). Counties and incorporated towns were often remiss with their payments, and pensions were often much in arrears. The Justices for purely frivolous reasons would stop or reduce a pension. Fortunately the Privy Council was well aware of these tricks, and kept as firm a hold as possible upon the local authorities. The volumes of the Acts of the Privy Council, right up to the end of the reign of James I, contain many letters from the Council to the Justices of various counties pointing out their deficiencies, and urging them to do their duty. A typical example is the following strong letter, dated July 11, 1622, sent by the Council to the Justices of the Peace of Buckinghamshire.

It is not unknown to you what clamore and complainte hath ben made unto us by the poore maymed soldiers, pencioners in that county, concerning their pencions of late withheld from them, nor how frivolous and causeles these pretences were found, whereupon that course against the poore men were grounded (*A.P.C.*, 1621-3, p. 28).

It would be possible to include many more letters of a similar nature, but I shall content myself with one only, which deals with a military surgeon, and shows what alteration has taken place in the status of the military surgeon during the last three hundred years. This letter is from the Privy Council to The Mayor and Aldermen and reads as follows :—

Wee did of late addresse our letters unto yow in the behalfe of this poore man, George Rayne, that in regard of his longe service as chirurgeon in the warrs, being imprest out of that county and citty, yow should affoarde him some competent meanes of reliefe, as might be aunswearable to his former services, and his present necessitie ; and thinke it very strainge to find that our recommendation was so far sleighted as neither to move you to comisserate the poor man's estate, nor to shew us cause to the contrary, and as your dutie, and the respect yow ought to beare to the direccions of this board, required ; and doe therefore hereby require you, that, without further delay or trouble to the petitioner or this boarde, you cause such provision to bee made for his reliefe and maintennance, as by the statute is provyded, or otherwise to make knowne to us the cause of this refusall. Whereof wee require yow not to fayle (*A.P.C.*, 1615-6, p. 237).

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OPHTHALMIC SURGERY IN WAR

BY

Lieutenant-Colonel G. C. DANSEY-BROWNING

Royal Army Medical Corps

Adviser in Ophthalmology to the Army

A Lecture Delivered at Exercise "Bamboo"

THE prime duty of medical units in the Field is that of the speedy evacuation of casualties, but it is important to realize that a certain proportion of battle-casualties require urgent surgical treatment as far forward in the line of evacuation as possible; that is they must be operated upon at the forward Casualty Clearing Station.

There are three small specialist units attached to the Casualty Clearing Station and these may have to deal with the treatment of up to 10 per cent of all the wounded who require surgical treatment at the C.C.S. These units are the Ophthalmic Team (previously known as the Mobile Ophthalmic Unit), and the advanced sections of the Mobile Neuro-surgical and Facio-Maxillary Units. The nickname for these three units is the Trinity, and they have to work together to be really efficient because wounds of the head and neck region generally affect all three of these areas. The forerunners of these units first worked together in the field as long ago as 1917.

OPHTHALMIC BATTLE-CASUALTIES

Two and a half per cent of all live-wounded to reach the C.C.S. have sustained some ophthalmic wound. The greatest ophthalmic hazards of modern warfare are from shells and mines while the greater efficacy of the modern explosive has caused the percentage of eye-injuries from blast to rise from 6 per cent in the 1914-1918 war to 40 per cent in the 1939-1945 war. Projectiles also these days are made from alloys that are only feebly magnetic and this counter-balances in the "beneficial" effect of the greater fragmentation (whereby the wounds tend to be caused by smaller bits of shell, etc., than in previous wars).

The modern method of extraction of intra-ocular foreign bodies is known as the Posterior Route Method. This is extremely effective in contrast to the older Anterior Route Method wherein, irrespective of the wound of entry, all fragments were dragged out through the front of the eye with consequent grave disturbance of vision.

Another interesting point arising from the modern type of propellant and projectile is that the through and through wound of the globe is extremely common.

But we must remember that unless there be effective administrative use of the Ophthalmic Team all the benefits of forward ophthalmic surgery are lost. Thus in Italy 40 per cent of intra-ocular foreign bodies were extracted in the mobile units just behind the line and in the B.L.A. 69 per cent of I.O.F.B.s were removed in that theatre of war. Yet in Burma where they did not use ophthalmic units and simply evacuated straight back to Base Hospital down a long L. of C., the greater number of eyes with intra-ocular foreign bodies were lost.

Protective devices such as a plastic visor or a helmet of the "coal-scuttle" variety if generally introduced, it is estimated would reduce the number of eye-wounds by anything from 12 to 20 per cent.

When "Gas" is used the number of men with true ophthalmic lesions is much less than is generally expected. Mustard gas lesions should be treated with albucid to limit secondary infection. It does not neutralize the corroding agent whereas British Anti-Lewisite (B.A.L.) has a definite neutralizing effect on lewisite if introduced into the eye early enough.

Whereas in the 1870 war 56 per cent of the German ophthalmic casualties developed sympathetic ophthalmia, there have been only two or three cases in the British Army in either the 1914 or 1939 wars and those were due to injudicious surgery during the evacuation of cases before the men reached the ophthalmologist.

The treatment of burns of the eye or adnexa should be profoundly conservative, mainly with emollients, and in the next war amniotic membrane is expected to be used a great deal in the treatment of corneal burns and in the repair of penetrating eye-wounds.

OPHTHALMIC POLICY IN THE FIELD

This must be twofold :

(1) The ophthalmic surgeon must be brought as far forward as possible to treat the casualty who requires urgent surgery. Our results fully justify this policy. In the 1914-1918 war some 67 per cent of all wounded eyes were lost while in the 1939-1945 war (in spite of the Burma figures) only 37 per cent were lost. At the end of the First World War some two thousand military blind were received into St. Dunstan's yet in this recent war in all their branches at home and overseas from civilian, Empire and military casualties from all three Services they have had to train only 500.

(2) The second ophthalmic policy is that there must be "No Touch." There must be no interference with the dressings of ophthalmic wounds from the time of the application of a dressing at the Regimental Aid Post until the man reaches the Ophthalmic Team. Again when the casualty leaves the Ophthalmic Team there should be no need for his dressings to be touched until he arrives at the Base Ophthalmic Wing of the General Hospital.

MEDICAL OPHTHALMOLOGY IN THE FIELD

The principal military value of the Ophthalmic Team lies in the prevention of the evacuation of cases of (i) minor disease of the eye, (ii) refraction cases,

also in the immediate repair or provision of spectacles to the soldier in the field.

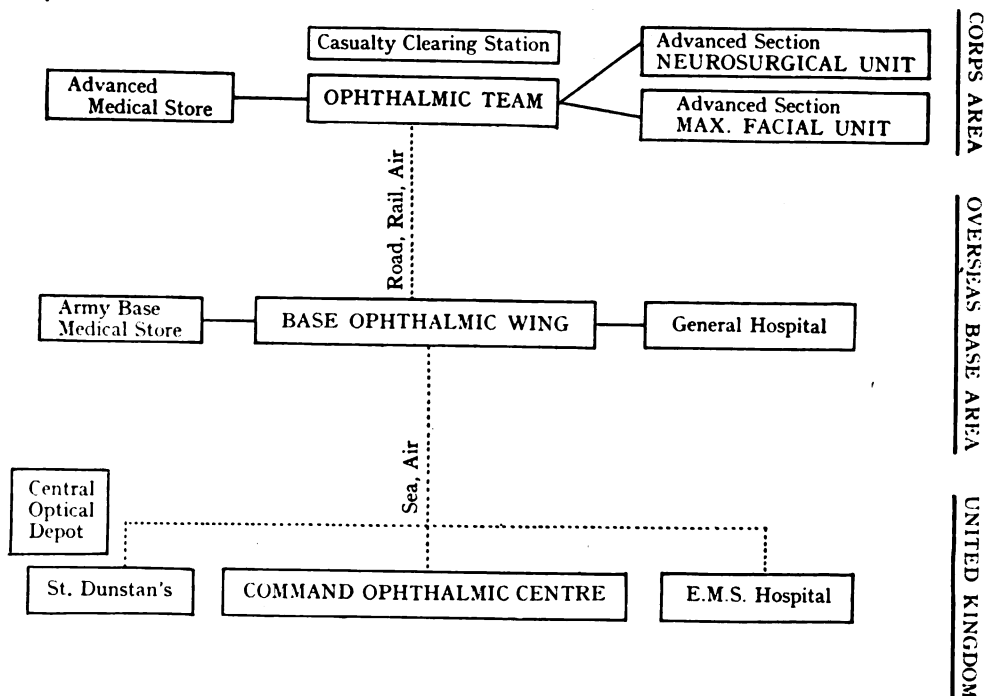
There are three major causes of men "reporting sick" to which attention should be directed:

(1) Night-blindness which in the British Army is largely a psychiatric problem. This scarcely exists in advancing armies and must be strictly differentiated from defective night vision which does exist and has a demonstrable ocular pathological basis.

(2) Trachoma which is in reality a chronic conjunctivitis and is only slightly contagious. There are, however, very infective epidemics of gonorrhoeal or Koch-Weeks ophthalmia which are loosely called "trachoma." If the eyes of men suffering from these last two acute conjunctivites be bandaged up they will inevitably be lost through panophthalmitis.

(3) Nutritional amblyopia which exists among Europeans released from rigorous oriental captivity at starvation level. It is vital that immediately on release these men be fed on a high protein, liver and marmite diet with an abundance of vitamins in the hope of reversing the changes in the C.N.S. before it be too late. This therapy must be started at once and not await the man's evacuation to the United Kingdom.

OPHTHALMIC ARRANGEMENTS IN AN EXPEDITIONARY FORCE



SCHEMATIC REPRESENTATION

System of Ophthalmic Line of Evacuation and Optical Replenishment

(A) There is one Ophthalmic Team allocated per Corps. This is usually sited at the level of the C.C.S. that is open to receive casualties from the front. The ophthalmologist has with him nursing orderlies (and we hope in the next war Ophthalmic Nursing Sisters), an optician and amongst his equipment a Giant Magnet and Diathermy apparatus. He has two vehicles one of which is the optical workshop with lenses, grinding stone, etc.

(B) From the Ophthalmic Team the sick and wounded are evacuated by road, rail or air down the common channel of evacuation to the Base Ophthalmic Wing. This Base wing is merely the designation of the ophthalmic portion of the receiving Base Hospital that has ophthalmic wards and an ophthalmic department for the reception of casualties. Not all General Hospitals have these wings and they are generally allocated on a basis of one per two Corps.

The above set-up has not changed in the last thirty years and can be epitomized as follows. Put a youngster who is an efficient operator and also is "field-worthy" at the Ophthalmic Team and put a really experienced "Harley-Street type" of surgeon at the Base Ophthalmic Wing. Also see that there are trainees available to learn to refract and to give anæsthetics.

The Ophthalmic Adviser to the particular theatre should be on the strength of the most important hospital. He must have free access to the Consultant Surgeon, have all ophthalmic problems centred on himself and be able to tour his ophthalmic units and hospitals without hindrance and regularly. He must be kept fully in the picture on all personnel questions, e.g. trainees, and, the most important part, the supply side.

REPLENISHMENT

(A) Drugs, dressings and instruments are obtained as in other medical units. The Adviser should, however, keep in close liaison with both his ophthalmologists and the "Q" side to obviate unnecessary delays in meeting indents.

(B) Optical: The two optical mobilization sets that the Ophthalmic Team carries are replenished by the team's optician from the two mobilization sets carried by the Advanced Medical Store (establishment one per Corps).

The optical replenishment of the Advanced Medical Store is done from the four optical mobilization sets of equipment in the Army Base Medical Store (establishment one per 150,000 men in the Force).

The optical industry in the United Kingdom pour their lenses, frames, etc., into a central optical depot in the U.K. and this depot meets the indent demands of the Army Base Medical Stores overseas.

THE OPHTHALMIC TEAM IN AN ASSAULT FORCE

A "light" portion of the ophthalmic team consisting of the ophthalmologist, operating room assistant, optician and the minimum tools of each man's trade should go ashore without any vehicles with the heavy section of the first C.C.S. to land. The remainder of the Team and the vehicles should land with the ancillary troops of the first Corps ashore.

THE OPHTHALMIC TEAM IN A RETREAT

Men on this occasion do not need spectacles so the optician and vehicle of the optical workshop should go back to the concentration area for medical units. The "thinned-out" team comprising the ophthalmologist, O.R.A., and one vehicle should move back in such a fashion that they remain to operate at each C.C.S. that is taking in casualties from the front.

MILITARY OPHTHALMIC ARRANGEMENTS IN THE UNITED KINGDOM

(A) There must be one main operating centre in each Command in addition to the outlying ophthalmic centres which may be in C.R.S.s. If special ophthalmic labels be stuck on the W.3118 then the sorting of convoys of wounded is facilitated at the disembarkation port. The blinded men should be routed to St. Dunstan's, and the others in rotation to each main centre in Commands. There must also be intelligent use of the E.M.S. hospitals where such hospitals are near the man's home and where there are ophthalmologists on the E.M.S. staff.

(B) But the prime duty of the ophthalmologist in the U.K. is the treatment of the recruit. The National Service Boards eliminate about 1 per cent of the recruit entry for gross ophthalmic defect. A further 10 per cent have to be examined by the military ophthalmologists to "pulheimize" them and to "kit-up" with spectacles the 5 per cent of men who require these aids to make them militarily effective to carry out their duties in forward areas.

This required in the 1914-1918 war some 131 optical centres and in the 1939-1945 war some 48 optical sections in the United Kingdom alone. In 1946 when there were 186 ophthalmic commitments for all theatres, the United Kingdom centres required some 86,000 pairs of spectacles per annum.

If the optical industry can be persuaded to scatter its production units over the country as a protection against air attack then there will be no need for any failure in any future emergency. I would emphasize that point and also suggest a series of Army Spectacles Depots be set up in cadre in the main "Army" stations overseas and that these be geared to the local optical industries.

CONCLUSION

The fighting man in the next war will produce many problems that will interest the ophthalmologist: protection against the atom bomb, infra-red apparatus for night-fighting and stereoscopic range-finders for all forms of guns, etc., etc. We do realize, however, that the ophthalmic set-up that I have outlined above will need modification and for this reason are keeping it extremely flexible.

Clinical and Other Notes.

MEDICAL RECORDS IN THE ARMY

BY

W. E. CONWAY

Registrar

IN the medical notes of the *British Medical Journal* of May 29 of this year there appears a brief note which introduces the new *Journal of Medical Records*. The note goes on to say that it will provide an opportunity for an exchange of views for those working in Medical Records Departments in hospitals and other medical establishments.

It occurred to me that many officers who have been in the Corps for some time would ask themselves what was there in Medical Records to justify the formation of an Association in its name or that the Association could go so far as to commence a Journal dealing with their affairs. Officers who have been in the Corps only for the short period prescribed by the Government and who have come from hospitals where medical records are efficiently kept, will have noted, I feel sure, the extent to which Army medical records fall short of standard and will not be so surprised at the activities of the Medical Records Officers' Association.

However gladly I accept the task of writing on this subject I must confess my shortcomings in attempting to write an article for the Corps Journal in which I intend to show the importance of Medical Records, how efficiency in their maintenance may be achieved and some methods in detail which may be of assistance to R.A.M.C. officers who are remaining in the Corps and to those about to return to civilian life.

I can think of no better opening than to give in full an Address made by Sir Hugh Cairns, *K.B.E.*, *F.R.C.S.*, who has kindly given permission to publish. In passing I would like to say that the influences of Sir Hugh and other eminent medical gentlemen who visit this hospital can be felt in the medical records at the Military Hospital for Head Injuries, Wheatley, where the medical records, by no means perfect, are at least the most carefully kept and easier of access than in any other military hospital I have seen in recent years. I have also to pay tribute to my predecessor, Major T. Walkley, *R.A.M.C.*, for his part in obtaining this very happy state of affairs.

This is the text of Sir Hugh Cairns' lecture which was given to a Course Conference for Hospital Records Officers organized by the Nuffield Bureau of Health and Sickness Records.

CLINICAL RECORDS IN SURGERY

BY

Professor Sir HUGH CAIRNS, *K.B.E., F.R.C.S.**Nuffield Professor of Surgery at Oxford*

I AM glad to have the opportunity of talking to records officers about the subject of clinical records for it is important that you should understand how deeply the clinical life of a surgeon is bound up with his case records ; and it is important also that clinicians should understand the problems of the records officer with whom they work.

Of the value of good case records to the individual patient there can be no doubt. Life has been lost through lack of precise knowledge of the previous illnesses and operations of a patient. It is the bounden duty of the surgeon to place on record what he has found and what he has done when operating on a patient ; and in the interests of the patient it is the duty of the hospital to conserve such records in such a way that they can be promptly referred to if the patient falls ill again in later years. I have never found patients unwilling to have their medical history placed on record, whatever their station in life. When they give us their history they are placing their trust in you as well as in the doctors, and the records officer like the doctor must regard such confidences as sacrosanct. This should be the first rule for all who work in records offices.

Of the value of hospital case records from the point of view of hospital statistics there can also be no doubt, but it must always be borne in mind that these statistics refer to a highly selected sample of individuals. They tell more of the activities of the hospital concerned, and of the interests at the time of the doctors who work in the hospital, than they do of morbidity and mortality in the population at large.

CASE RECORDS IN THE TRAINING OF THE DOCTOR

I am more concerned with the value of clinical records in the training of the young doctor and for purposes of medical research and it is on these aspects of our joint work that I wish to give you something of my reflections during the last thirty years.

What is a good case record ? I will consider only in-patient records ; out-patient notes are important both to patient and doctor but in my experience they are in general of little value either in training the doctor or in medical research. I exclude from this statement the out-patient follow-up notes after the patient has left hospital. Also I do not wish to imply that research cannot be advanced by *ad hoc* investigations on out-patients. What I mean is that I have rarely found the ordinary out-patient note of a patient of any value in clinical investigations.

A good case record gives comprehensive and accurate information about the patient's civil state. It gives a picture of his background—of his family and past history, of his daily life. It gives in detail the history of the illness

for which he has come to hospital, the physical signs found on examination at the bedside, and, in easily conservable form, the results of laboratory, radiological, ward and other special investigations.

Then should come a short summary of the positive findings and a reasoned statement of the diagnosis, the treatment recommended, and the prognosis; this is from many points of view the most valuable part of the note and the part that is most often neglected; without it it is often not possible in reading old notes to see how the surgeon's mind worked or why he did such and such an operation; without it the house-surgeon, for it is he who should write this summary, may not learn as quickly as he should to integrate the clinical and laboratory evidence about the patient's illness, to give each symptom and sign a graded value, and thus to produce a clear clinical picture for which some pathological explanation must be found. That is how a diagnosis should be made—by a careful synthesis of all the facts about the patient and then by finding the best explanation of those facts in terms of pathology. I have no use for the long clinical note, which is a mass of ill-digested facts; some young doctors—and this seems to happen more often in some medical schools than in others—produce with long toil a massive clinical note about a patient, and at the end of it have no clear picture of the essential points in the illness, or of what is the matter with the patient. The summary of the positive findings should not be a repetition of the important findings in the same terms as were recorded in the examination but should integrate these facts, placing the emphasis on the pathological or syndromic aspects rather than on the individual facts.

LEARNING TO TAKE CLINICAL NOTES

In learning to take clinical notes the student of medicine usually goes through three stages. At first his clinical note is usually too short and lacks essential information. As he learns to be systematic in examination and learns how to elicit the points of a clinical history his note eventually becomes good but long. The final stage in note taking, which usually only comes after years of experience, results in the case record which is good but short—compiled with great economy of words but omitting nothing either of a positive or a negative character which is essential. In writing such a note the experienced clinician sifts, weighs and integrates the information as he receives it from the patient; as a result of long practice and wide knowledge he summarizes the clinical picture as he proceeds with the history and the examination, and at the end he has a fairly sharply defined clinical picture for which from his pathological experience he can find an explanation.

This is the most important part of the clinical art. It is a highly specialized process of inductive reasoning. In some quarters the fashion is to belittle its value to the advancement of medicine, and the modern laboratory aids to diagnosis tend to conceal its importance, not only to each and all of us when we are ourselves the patient, but also to any serious clinical student of disease. The quickest and easiest way to acquire the art, or technique of the clinician, is by systematic note taking on the lines which I have described.

So far I have described only those parts of the clinical record which deal with diagnosis. The treatment should also be meticulously recorded, and in this connexion I wish to state my belief that the only person who is competent to record the pathological findings and the treatment carried out at an operation is the surgeon who performs the operation. The practice of delegating the recording of an operation to the surgical dresser or house surgeon is in my opinion a bad one.

When the patient leaves hospital a discharge note should be written. If the patient dies the discharge note should give the details of the final stage of the illness, and the clinician's first impression of the findings at post-mortem examination. It is most unusual not to learn something of value at a post-mortem examination which will assist one to get a better result in the next case of the same disease, or will provide material for a better knowledge of the pathology of the disease. During the last thirty years the leading American medical schools have affirmed that the keenness and efficiency of a hospital may be gauged by the percentage of post-mortem examinations in its fatal cases.

If the patient survives the discharge note should contain a detailed account of the effect of treatment on the symptoms and signs as set out in the summary of positive findings. This helps to inculcate the critical attitude in the house officer. The discharge note should also state what is to happen to the patient and, whenever applicable, what steps should be taken to prevent recurrence of the illness for which the patient has been treated.

Finally there should be the disease indexing of the case record and a letter to the patient's doctor. This is best done at a weekly history-meeting attended by all the doctors of the firm or department. For me this history meeting has always been one of the most interesting hours of the week, when all attending speak their minds about the cases, and problems for future investigation are often crystallized.

No clinical record can be regarded as complete without follow-up. Otherwise how may the hospital doctor judge whether his treatment is really satisfactory, or gain an intimate knowledge of the life history of disease? There is enormous labour for records officers and social workers in the follow-up, and I doubt whether it is yet well done in many clinics in this country.

RECORDS FOR RESEARCH

Much can be learned about disease from clinical records. There are few diseases of which the life history has yet been thoroughly studied. From time to time good clinical records, well preserved, will provide evidence of heredity of diseases in which the heredity or familial aspect could not be discovered by the family itself. Polycystic kidneys and German measles provide two dramatic examples of the value of clinical records in assisting important discoveries and it is necessary to sound a warning note, for this does not happen often. I do not believe that it is right to include in a clinical record masses of *detailed* information, e.g. about the patient's relations, in the hopes that, in some way

as yet undefined, it may be useful to future workers. More often than not if years later these facts are reviewed it is found that some essential piece of information is missing. Recording of masses of facts is a snare for the enthusiastic, hard-working but intellectually lazy doctor ; and also for the bureaucrat who sits in some room a long way away from any hospital, and does not have the labour of compiling the information or, usually, the responsibility of producing any conclusions from the information. (I do not decry the routine recording of details for carefully thought-out *ad hoc* investigations.)

HOW MAY GOOD HOSPITAL RECORDS BE OBTAINED ?

Most of the work of clinical recording is done by medical students and by young doctors in their early years of post-graduate training, and every inducement should be given to them to write good notes. First there must be a system of case-taking which, while it need not be adhered to rigidly by the initiated, nevertheless provides a guide for the young student. The next essential is that the notes of the students and house officers should be read by their chiefs ; persistent neglect of this obvious maxim can have a most disheartening effect upon a beginner. For the house officer in hospitals where notes are type-written it is a good idea to provide a carbon copy which the house officer may retain. For over twenty years I have used a dictaphone for recording and have found it a great advantage, particularly in cases requiring a long note ; the physical labour of writing a description of an epileptic attack or of a long operation is a deterrent to detailed recording which is easily overcome by the dictaphone.

The establishment of a good tradition in regard to the quality of clinical records in any hospital is a slow and difficult business, and can only be achieved by whole-hearted co-operation of all the medical staff. The difficulty increases enormously with the size of the hospital, and I think it is seriously open to doubt whether hospitals as large as 1,000 beds can develop a high standard of clinical notes throughout the hospital, even though the standard in some individual units of the hospital may be high. In such hospitals individual units tend to contract out of the general system and to maintain their own unit records separately. This is not good for the hospital.

There are certain obvious duties of the records officer which you are more familiar with than I am, and I need not adumbrate on the safe-keeping of notes, the preparation of a consistent disease index, an accurate name index and so on. There are, however, certain duties of the records officer which are insufficiently stressed.

COMPLETION OF THE CASE RECORD

The first of these is what we may call the completion of the case record. By this I mean that before the note is filed its various components must be arranged in order according to a pre-arranged system. A check must be made by an experienced records officer to ensure that the note is complete, that the operation notes have all been written, that the pathological reports are complete,

in cases of death that the post-mortem report is included or that there is a note to say that post-mortem examination was not held, that the diseases from which the patient suffered have been correctly indexed—and so on. Where there are deficiencies they must be made good, and here though the records officer can do much by tact and persuasion, in the final analysis it is necessary that the medical staff of the hospital must set up a disciplinary machine in the form of a records committee which has the duty to report to the central administration of the hospital any serious dereliction of duty in regard to notes.

Notes should be stored and preserved with the same high standard of care as pertains in medical libraries. This cannot be carried through unless the records department has a most efficient calendar index for checking in case records after the patient has been discharged from hospital or the case record has been borrowed for one purpose or another. Nor can it be carried through without the active co-operation of the medical staff. I would go so far as to say that I would not recommend anyone to apply for the post of records officer at any hospital in which the medical staff of the hospital had not given evidence, as for example by the establishment of a records committee, that they were prepared to sink their individual whims and fancies for the good of the hospital as a whole, and conform to rules for the maintenance and safe keeping of clinical records.

(To be continued.)

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Original Communications

THE TRAINING OF FIELD MEDICAL UNITS

BY

Colonel F. M. RICHARDSON, D.S.O., O.B.E., M.D.

Late Royal Army Medical Corps

[A Series of some five articles to be published in consecutive numbers of this
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I.—INTRODUCTION

MODERN war calls for the total mobilization of medical and nursing man power. Men and women of these professions in the home country and abroad may all be in danger from enemy action, and must all to some extent keep abreast of current developments in war surgery and medicine; but it is the Army medical officer who must learn more new tricks than any of them. The civilian is probably at work in his own home town or county, battered and blacked-out perhaps, but still Home. The naval M.O. works in his sick bay and in the familiar territory of the battleship, so long as it remains afloat, whatever the changes in the battle. The R.A.F. medical officer cannot play a part in the whirlpool of an air battle, and, whilst his medical reception stations advance as the airfields advance, they still remain essentially the same. The Army doctor, however, must learn to adapt his work to innumerable changes in the nature of battles, fluid or static, and must be able to find his way by day or night confidently and safely around the confusion of the battlefield—and must teach his men to do so too—whether the formation with which he is serving is landing on hostile territory from the sea or air, crossing rivers great or small, fighting and advancing, or withdrawing, in close thickly wooded country, through prepared defensive positions, in villages or towns, in trackless desert or in continental country whose multiplicity of roads and tracks where it may be even more difficult to find one's way than in a desert; or in difficult mountain ranges in snow and mist—often the hardest of all.

It was lucky that there were for most of us during the last war long periods in which we could train ourselves and our men, and could adapt our methods to the lessons learned by those who had been in battle, for I do not think that in the interval between the two wars we were taught enough of these matters.

Experience in five Field Ambulances and a study of the standards of training the men of those units and of men posted to them from other units and from training establishments, led me to believe that the training of other ranks of the Royal Army Medical Corps was not always on sound lines, even quite late in the war. In war, as in peace, recruits must do a lot of parade-ground work and Physical Training, and our men had been well grounded in these, so that field units to which they were posted had the advantage of being able to concentrate on field training. Most of them had been very well taught in such subjects as anatomy, first aid, and nursing, the value of which to their patients should not be underestimated. That few of them had been put through the obligatory tests of elementary training in chemical warfare was luckily of little significance. The serious defect in their training—possibly due to lack of training time—was a lack of knowledge of Fieldcraft and of general military knowledge—e.g. what a division is, how it is commanded and administered, how it fights a battle, and how medical units fit into this picture. Only a man with this knowledge is a really reliable Field Ambulance soldier, able to act on his own and entitled to consideration for promotion to non-commissioned rank in a field medical unit, where parade-ground efficiency is less valuable than knowledge on which a man can base ability to use initiative in unexpected situations. Many were so ignorant of simple fieldcraft that when marching straight into the rising sun they might reply North, South, or West when asked in what direction they were going, and their estimations of distance might vary between five hundred yards and five thousand. These things must be taught and practised, for they do not come naturally to men whose estimation of direction and distance has depended on noting which bus route they were on, and the countryman is often little better than the townsman.

I must say that I was surprised to find that a fully trained member of a Parachute Field Ambulance during cross-country marches in the Palestine hills could not point out by night, or even by day, the direction in which our camp lay. He had not been posted to an ordinary unit because of unsuitability but because he had had a spell of detention, and he was a first class young soldier who soon became a proficient mountaineer and navigator. I saw no reason to doubt his statement that he had never been taught direction finding, identifying points of the compass by the sun and stars, and similar things so essential to a parachutist.

It is comparatively easy for M.O.s and experienced R.A.M.C. N.C.O.s to teach men the technical subjects needed for their nursing orderly qualifications, and even men of a low standard of education can often become expert in bandaging and splinting, since they are often more accustomed to working with their hands than with their brains. It is much more difficult to teach them to

be confident in finding their way around unknown country or around a battle-field, and to use their maps and their heads in any circumstances. Proficiency in navigation and map reading does not come naturally to most of us, and cannot be acquired without constant practice by day and night in various types of country, roads, forests, moors, deserts, or mountains; but that it can be taught to soldiers is indicated by a report on six private soldiers of one of my units who were ordinary volunteers for ski training. They were not specially selected for any reason other than that none of them was a member of any unit team and so could be spared; whereas all other members of the classes at the Middle East School of Mountain Warfare were picked men. The report said "in navigation they are the equal of most officers who have come to us."

I can think of no good reason for hoping that this article will command a more attentive reading than I gave to similar articles in the golden years between the wars, when I was more interested in purely medical works or in the literature of such pursuits as pigsticking and piping. Mention of the latter pursuit recalls the solemn occasion of my interview as an applicant for a commission in the R.A.M.C. When asked what were my hobbies, a word associated in my mind with fretwork and stamp collecting, which I had long abandoned, I replied "None Sir." I could see at once that this was a false step, and for a time I felt that my fate hung in the balance. The Corps seemed to be about to be deprived of what I had fondly hoped might one day prove to be one of its brightest ornaments. However, when we had agreed that such sports as golf and horse riding could not be defined as hobbies, I was pressed to reveal what I did with my spare time, and I admitted that I played the Highland bagpipe. "Aha," said the Scottish inquisitor, "A musician." "Nothing of the sort," said the Englishman, "A menace."

I must bring these discursive and provocative introductory remarks to an end by saying that I hope in this article to pass on some of the lessons learned in various campaigns and in the far longer periods of training during the last war, and to encourage others to do the same. It is probably salutary that there has always been a tendency for our tales of "What we did in the Western Desert" to be received by those who were not there with markedly less reverence than has been accorded by succeeding generations to the tales of campaigns and training in the Sinai Desert told by the Children of Israel. I doubt if any one jeered at Joshua for having "sand in his ephod."

Quite recently I read a paper written by my father on the work of Cavalry Field Ambulances in Palestine in 1918, much of which could have been reproduced unchanged in a 1941 Training Directive. Perhaps it was a pity that a paternal government of that day had not thought of the advice to "Ask your Dad." In this connexion one might recall that at one time Wellington was slightly referred to by the Whitehall Generals as "the Sepoy General." Desert experience may not be a complete Bible for future wars, but, in the desert, battle technique was certainly reduced to bedrock essentials in many respects. In future wars an open and elastic mind, and a capacity for original thought

untrammelled by too slavish adherence to old methods will be essential, but underlying principles do not change very much, and the lessons of past experience will always be of value.

II.—TAKING OVER A FIELD AMBULANCE

The methods of training to be described are based upon the Field Ambulance which is the most important medical unit in war, and the one in which training in the subjects which are the most difficult to teach is especially needed. We Field Ambulance men always regarded ourselves as the Corps d'élite of the Army medical services in war and, I think, with good reason. From the rifle company to the great hospitals in the United Kingdom the medical services stretch as a closely knit chain. However perfect the final links of that chain may be, unless it is firmly hooked on at the top it will fall to the ground, and as the regimental medical establishments move around with the changes in the battle, too busy to look over their shoulder, it is the Field Ambulance which must keep the hook firmly attached. To vary the metaphor—the most modern well-equipped hospitals is useless in emergency if the front door is locked and its Reception Department in chaos. If the R.A.P.s are the front door to the chain of C.C.S.s and Hospitals, the Field Ambulance is not only the Reception Department, but it must find the faithful porter who is ready to see that the front door is always open and attended.

There are many degrees of urgency in the training of units, and this must be remembered when criticizing and considering some of the methods which are described here. The man who had to train his unit rapidly to fit it to take part in a campaign soon after it was raised may say of some of the methods: "Good Heavens—how could one find time for all that?" He should remember that for many units stationed for long periods of enforced non-operational idleness in some remote desert with few recreational outlets, training was the vital factor in preserving morale and a sense of high purpose amongst all ranks. It was then that one had to rack one's brains for devices to sustain interest, and instead of plugging away interminably at the same old lessons, to make men realize that they might suddenly be expected to take part in a desert battle, in jungle or mountain warfare, or in an opposed landing, or might find themselves prisoners with the problem of escaping and reaching friendly territory without a compass, water-bottle, or food.

If one can make everyone realize that these are problems not only for the C.O. and officers but for every man to solve for himself and for the general good of the unit; and if one can make training so alive and interesting, with constant emphasis on the practical application of all that is taught, then men will not get bored by it, even when one uses a large proportion of a brief period of rest during actual battle conditions to brush up some lessons which have been brought out during the battle itself. Then the unit will be not only keen and efficient, but contented and inspired by that *esprit de corps* which can only spring from the knowledge that one is a member of an efficient and

well-led unit, and one which is valued and trusted in every emergency by one's combatant colleagues.

Our men must be made to realize that for every man who fights the enemy many are needed to sustain him. They must be taught how vital are the medical services to the preservation of high morale which rates as second to nothing as a battle-winning factor. They must know how they fit into the team of the formation with which they are serving, and must be made to realize that only troops who have never seen a battle would underestimate the value, and indeed the valour, of the many ancillary troops who do their work under fire and without the stimulus of active combat. We know how proud of themselves and of their units Field Ambulance men become when they have been tried in battle. This pride, and this attitude to our work, must be deliberately taught and fostered during training.

PRELIMINARY SURVEY OF UNIT ADMINISTRATION

Here it may be helpful to imagine ourselves in the position of a C.O. who has just taken over a Field Ambulance, and to suggest what may be his first steps in ensuring that its organization and training are on sound lines. Remembering that from the moment that he assumes command he will be held responsible for any losses by fire and theft, and for the hundred-and-one little things by which a unit may incur the displeasure of the higher command—and it is surprising how often such things crop up within a few days of joining—the new C.O. will certainly want to spend a few days investigating the administration of the unit and discussing with the second in command the way in which he likes things to be done. Although no amount of training can make a unit truly efficient unless its own internal administration is good, a detailed consideration of these matters is outside the scope of this article. Only an outline of the points to which attention should be directed is given here.

WELFARE OF OTHER RANKS: PROFESSIONAL, PERSONAL, AND SOCIAL

Is a unit SENIORITY ROLL maintained, and some means by which one can readily see when men become due in terms of length of service for up-grading, so that arrangements can be made to complete their training in time?

A large board may be kept showing the dates on which trade tests are to be done. Men on special jobs or on detachment must not be overlooked, and when men leave the unit on posting full details of their standard of training and of the dates when they become due for trade tests must be sent to their new unit. A seniority roll is important because, although in wartime one tries to promote those who are best suited for the job, it is only fair when there are a number of apparently equally well qualified candidates for promotion to take seniority into consideration.

A list of potential N.C.O.s should be kept, and reports on their progress made periodically by officers and N.C.O.s under whom they work.

Is the card index of potential officers (A.F.B. 2624) maintained, and is there a properly constituted unit selection board under the second in Command?

The procedure for selecting potential officers is fully described in the pamphlet "Selection of Potential Officers: 1945". All potential officers must be tried out as N.C.O.s and it may be found that even if for some reason they do not become officers they make good N.C.O.s.

Is the pay clerk efficient, and are A.B.s 64 properly kept, regularly inspected and balances inserted when notified by the Regimental Paymaster on A.F.N. 1483? This Army Form should be regularly obtained from the paymaster, and men given an opportunity to comment on their balances. A.B. 64 should be carefully checked when a man is posted from the unit.

Is the unit welfare officer active and in close touch with the Divisional Welfare officer—the D.A.A.G. (Welfare)—does he visit detachments, and can men easily get in touch with him? Is the comfort of men's billets, etc., of the highest standard attainable in existing circumstances, and not less than that of other units including Brigade Headquarters? It is certainly important from time to time to subject men to very vigorous living conditions lest they get soft but if, after periods of discomfort on training schemes or in action, they can return to comfortable quarters where they can live a civilized life their self-respect, morale, and personal hygiene will remain on a high level.

Are facilities for indoor and outdoor recreation adequate; do all men get a chance to take part in games, and are attached personnel given equal facilities with members of the unit in all these activities?

Are arrangements good for men wanting private interviews with the C.O. or other officers? Usually this is very satisfactory in medical units in which the officers, being mostly doctors, are experienced in giving advice on personal problems, and well aware that men with unrelieved personal worries are likely to do bad work, to get into trouble, and to be "accident prone" if drivers. Do men understand the difference between personal problems and official grievances, and is the proper method of seeking redress of the latter understood, and the provisions of Secs. 42-43 of the Army Act published in orders at least quarterly? Do all ranks understand the regulations governing compassionate leave, and is ordinary leave properly administered, a roster kept, and men given adequate warning of the probable date of their leave?

Are padre's hour, church attendance, and moral and spiritual welfare in general satisfactory? Under this heading might be included the desirability of lecturing to men on sex rather than venereal disease with the aim of helping young men to adapt themselves to the claims of sex, just as good man management aims at adapting them to the claims of society and of occupation. Alfred Adler postulated the need for the well-integrated personality to be adapted to these three things and in the November 1948 number of this journal I suggested how this could be done, and how it should help to make an Army mentally healthy and less prone to the incidence of war neuroses.

Is propaganda on savings adequate, and is the Army Savings Association well supported? Even if it is not it does not always mean that men are not saving, as many do so by means of an allotment to relatives who invest the money for them. Are arrangements for mail good, and are the provisions of

Kings Regulations paras 1628 to 1631 observed, and is the Post Orderly a really good man for his responsible job? You may be very badly let down if he is not.

What is being done about education and current affairs, etc.? The unit education officer should be assisted by a unit education committee, and in addition to educational and current affair periods during training there should be encouragement and good facilities for men who want to improve their education in their spare time, including a Quiet Room for them to work in, books, etc. All men should know that it is part of the unit education officers' duty to help them with advice on resettlement in civil life, and that he is provided with pamphlets to guide him in this important activity. Good facilities also exist at present for men to take correspondent courses at advantageous rates. An information and news room should be organized as part of the education programme. Education should be of a high standard in medical units as a high proportion of the officers are University graduates and so presumably well able to learn how to teach. The subjects which our men have to learn demand a fair standard of general education. Handicrafts are a branch of education, and men who are good at that sort of thing are very useful in a field medical unit.

Are the institutes, canteens, etc., comfortable, properly run, well patronized by the unit, secure against robbery, and are the staff quarters hygienic? Are all ranks aware of how P.R.I. money is spent? A statement of receipts and expenditure and of the amount of NAAFI rebate should be displayed on the Institute notice board, and the quarterly balance sheet should be published in unit orders, in accordance with regulations.

No single factor under this heading of Men's Welfare is of greater importance to the comfort and well being of a unit than is messing. Samuel Pepys said of sailors that "to make any abatement . . . in the quantity or agreeableness of their victuals, is to discourage and provoke them in their tenderest point, and will sooner render them disgusted with the King's service more than any other hardship that could be put upon them." It is not necessary to go into detail here since all medical officers are taught how to supervise this aspect of the soldier's environment. The C.O. should see the Minutes of the Messing Committee and satisfy himself that it meets often enough, that its members are changed from time to time, and that the men are satisfied that they are adequately represented on it. The Quartermaster, incidentally, should preferably not be a member of this committee, though he may attend its meetings in an advisory capacity provided that he is not allowed to prevent any suggestions made by members from being recorded in the Minutes on the grounds that they are impracticable. It is for the C.O. to decide whether or not suggestions can be tried. A most important section of the Messing Committee's Minute book is that for the recording of action taken. A very intimate liaison with the Divisional Catering Advisor is of inestimable value, and if he is treated as a most important ally the unit will secure for itself the help of the Army Catering Corps. The avoidance of food wastage, economic disposal

of swill, fuel economy, proper accounting for rations, and the supervision of cook's qualifications, their upgrading, etc., are all points of importance.

Are officers' and serjeants' messes properly run, rates of messing and subscriptions reasonable, mess meetings held regularly, etc.?

OFFICE ADMINISTRATION: SECURITY

Are all offices well run, supervised by the unit Security Officer; have all clerks read the Official Secrets Act. and King's Regulations paras. 1659 to 1670 and are the provisions of these regulations enforced? Are Officers' records up to date; the War Diary properly kept, and minor offence reports checked with conduct sheets? Are clerks being trained, and do they get daily exercise and reasonable time off? See the parade states and decide if the number of employed men is reasonable, and try to determine how many of them dodge training, and whether they are being trade-tested. It is important that the number of men employed as billet orderlies, pickets, night guards, in stores, etc., should be adequate for efficiency and to prevent robberies, but if the number is excessive training will be interfered with and men's nights in bed reduced.

Are there proper arrangements for ensuring that officers, and W.O.s and Sjts. too when necessary, read important letters, orders, and instructions. Are typewriters carefully used and maintained, and used only for official work? Since typewriters get knocked about on active service it is very important to have a list of people who are permitted to use them, and to make it an offence for anyone not on the list to do so.

Are unit standing orders good? If the new C.O. as a result of his probe into unit administration decides to add to or to rewrite them the necessary new orders can be published piecemeal in Part I orders until time allows of the production of a complete revised issue, which should preferably be neatly bound in a file cover. Too often standing orders consist of an untidy collection of sheets in which men are warned that various public houses in stations and even in countries, which the unit has long since quitted are out of bounds; or in which they are referred to innumerable orders and publications which they have no opportunity of reading. They should be so framed that they do not become out of date on change of location, or at least need only the revision of certain appendices; and rather than being a rehash of other orders they should have a personal note, and reflect the C.O.'s policy on certain matters, including the methods of running medical posts, etc. A special section dealing with Duties on Active Service is very useful and will be referred to later on. Are the various public funds properly administered, and is the unit in possession of the pamphlets "Notes on the Prevention of Fraud," "Notes and Instructions on Keeping the Accounts of Regimental Funds," "Notes for the Guidance of Officers Concerned in the Audit of Regimental Accounts," and other important pamphlets?

See the latest reports of any inspections by the Inspectorate of Army Equipment, and the Inspectorate of Mechanical Transport, and see if action

has been taken on all their recommendations. Careful study of these reports will provide a very useful insight into the general administration of the unit, and may point to many things which should be covered by Standing Orders.

It is not unusual to find that one officer, often a non-medical officer, is doing many jobs, such as Messing, Sports, Education, Welfare, Entertainments, Passive Air Defence, and Fire Officer. Such jobs should be distributed amongst all the officers, and changed about occasionally so that all officers are drawn into the life of the unit, and eventually become interchangeable. It is especially important that medical officers should not be employed solely in professional duties, and that they should realize that it is a great privilege, pleasure, and source of unending interest, to have men of their own to care for personally as well as medically. It is a good plan to show on a notice board in the information room a list of the officers doing the various jobs with details of the kind of advice which they can give.

QUARTERMASTER'S DEPARTMENT

See the records of the last stocktaking board of Q.M. stores and ledgers, and note what action has been taken to deal with discrepancies and deficiencies. See if the stores are well laid out and secure, and the method of drawing stores a good one. If the unit has accommodation stores these must be kept separate from its A.F.G. 1098 stores. Check the system by which the quartermaster satisfies himself that all stores issued to sub-units, billets, etc., are correct and properly accounted for, e.g. by monthly certificates. Are boot and equipment repairs satisfactory? Is there any accumulation of surplus stores, or are there deficiencies of things to which the unit is entitled—if so see the indents for these. Is there evidence of close and friendly liaison with the Ordnance authorities? e.g. visits by the Brigade Ordnance Warrant Officer, or the C.R.A.O.C. at which outstanding indents are checked. Look into the arrangements for salvage, for in war this is not just a matter for the Quartermaster but for an all-out unit drive.

The Quartermaster should accompany the C.O. on his first inspection of the unit's accommodation, at which, in addition to studying the cleanliness, adequacy, comfort, ventilation, washing, bathing, and drying room facilities, etc., careful note should be made of whether every man has his proper entitlement of bedding and that all bedding is aired regularly, blankets washed occasionally, and if paillasses are in use, that they are changed regularly and fresh straw provided. Have inspections of accommodation been regularly carried out and action taken on notes made at such inspections: are distribution lists of accommodation stores held in every room and accommodation stores inspected monthly in accordance with K.R. para 1339?

Barrack damages should be assessed as they occur and not left to mount up until no one can be held responsible for them.

This visit will be a suitable time to look at Firefighting equipment. Fire orders should be in every room and store, an officer should have been appointed

fire officer, and two N.C.O.s trained in firefighting so that they can train fire picquets. Liaison should have been effected with the nearest A.F.S. unit.

Is the Quartermaster active in securing all that the unit is entitled to, and is his department animated by a co-operative and friendly spirit, or does he rely for his success on an ability to say "No" to all requests and suggestions? In a medical unit the Quartermaster, and indeed the whole administrative staff, exist to serve the needs of the technical staff, and to ensure that they can carry out their professional duties unhampered by shortage of medical supplies or by any manifestations of "red tape." If a doctor has to be told that he cannot have something which he thinks that he really needs, he should be told so, not by the Quartermaster, but by the C.O., after due investigation. This attitude is not always adopted even by otherwise excellent Quartermasters—indeed the best hospital quartermaster's department which I have ever seen, although it deservedly won the highest praise from all inspecting officers, was roundly cursed by doctors, sisters and patients on the occasion of the weekly linen change, when in order to ensure that nothing was lost the wards were put to extreme inconvenience and discomfort, the avoidance of which by achieving one of the main objects of hospital administration—the comfort of patients—was surely worth the price of an occasional lost sheet.

MEDICAL HYGIENE AND SANITATION

Nothing much need be said under this heading except to observe that the O.C. of a Field Ambulance will find it hard to be an effective medical adviser to the Brigade Commander unless his own house is in order in such matters as the general health of his unit, absence of venereal disease, excellent unit and personal antimalarial discipline, full protection by vaccination and inoculation, health inspections, bath books, and first class sanitation of camps and billets. As to health inspections it is proper to hope that with progressive improvement in our soldiers' personal hygiene and sense of good citizenship the day will come when this invasion of their privacy can be dispensed with, but in war that enemy of armies in the field, the louse, is no respecter of persons.

MECHANICAL TRANSPORT

Although this has been left to the last it is impossible to exaggerate its importance. If the transport has recently been inspected by the I.M.T. or I.A.E. the C.O. has a readily available guide to the mechanical condition of his vehicles, to the general administration of his Transport section, and to the competence of his M.T.O. He should see A.B.s 406 and 412, vehicle kit lists, work tickets, accident report forms. "Standing Orders for Drivers of Mechanical Vehicles (Wheeled) and Motor Cyclists," "Inspection and Care of Army Vehicles," and should satisfy himself that drivers carry the proper documents at all times and that their vehicles are in good running order and equipped with proper accessories, tools, etc.; that all vehicles, including those on detachment, are regularly inspected; and that daily maintenance tasks are carried

out and recorded in A.B.s 412—the daily task indicator being shown in a prominent place and the daily task published in orders.

It is important that the C.O. should see A.B.s 406 regularly, and when recording his comments in these, which may with advantage be done in ink or pencil of a distinctive colour, he should record praise where it is earned. All vehicles must be properly marked with clean divisional and unit signs, the red crosses on ambulances kept clean, and tyre pressures painted on mudguards.

If he wants to avoid a bad report on the turnout of his drivers he should see that all of them have overalls and that the wearing of these whilst doing maintenance is a standing order.

Petrol, oil, and lubricants must be safeguarded against fire and theft, and properly accounted for.

All these points can be safely left to a good M.T.O. but of equal importance is the spirit of the R.A.S.C. members of the unit, and this is a matter for the C.O. himself. Medical units are singularly blessed in that their transport is in the safe hands of the R.A.S.C., as a result of this happy arrangement the transport of Field Ambulance is often the best in the division for the maintenance, convoy discipline, and general efficiency. Despite this, however, it is not uncommon to hear Field Ambulance commanders say that most of their troubles come from "the Transport," and this is unfortunate and often largely unnecessary. It is inevitable in war that many men are set to tasks for which they have little enthusiasm, and this is sometimes the case with R.A.S.C. men posted to medical units. Many of them would prefer to serve in purely R.A.S.C. units, and it is surprising how many of them prefer to drive the really heavy vehicles, despite the apparently harder work involved. R.A.S.C. members of Field Ambulances must be given a sense of the supreme importance of their work, as members of the senior Corps (if we exclude the one Sapper) in a mixed unit whose task is largely Transportation, and transportation of the most valuable cargo with which the R.A.S.C. are entrusted in war—human lives. Recognition of the senior status of the R.A.S.C. can on occasion be more than mere lip-service. At ceremonial parades of the unit they, as the senior Corps, should parade armed on the right of the unit. They can be told that once plans have been made and battle joined the success of the system of evacuation and the good name of the unit will often lie in the hands of a dispatch rider, or ambulance driver, and that therefore they must take part in a great deal of the training of the unit, and must have an intimate understanding of our work and of the methods by which we propose to discharge our function. I often emphasized this point by telling new drivers that a Field Ambulance might conceivably be better off if it had bad doctors and good drivers than if it were the other way round, since the worst of doctors might in the course of his career lose at most one or two lives by his badness—the human body being very tenacious of life—whereas a bad driver could lose them by the busload in any battle. It is a good plan to ensure that all R.A.S.C. men are good first-aiders

and, if time allows, to train most of the R.A.M.C. to maintain and drive vehicles, so that ambulance orderlies on detachment can help their drivers when they are tired or can take over from them if they become casualties.

Never must the R.A.S.C. become a sort of "private army" within the unit. They must be loyal and proud members of the unit in every way, whilst of course encouraging the usual friendly rivalry in smartness, in games, and so on between the various sections of the unit.

One must not forget that, as the daily life of the unit depends on the use of transport, and as ambulances are perpetually in use, and daily maintenance is never ending, the R.A.S.C. men are often the most hard-worked men in the unit. Even during rest periods in battle when the R.A.M.C. men may be relatively idle, they are still hard at it. Thus due consideration must be given to relieving the R.A.S.C. from certain fatigues which might otherwise be their duty—e.g. construction of tracks and improvement of entrances to camp, etc.—and to ensuring that they get as much rest as possible. They will naturally be alert to detect any favouring of the R.A.M.C. in the allocation of billets, etc., and they have if anything the stronger claim to such favours. In dressing stations one must have rest rooms for drivers, and give them tea and eyebaths in dusty weather, which helps to prevent eyestrain and conjunctivitis, and relieves fatigue.

This service should be extended to the drivers of all vehicles which visit the Field Ambulance. In Eritrea, where we depended very much on the use of B. vehicles returning empty, whilst the driver was waiting to see if we had a load for him he was given a cup of tea in one hand and an eyebath in the other. The freshening effect of this simple practice was quite amazing. To send drivers on their way without undue delay may be very important, but if they cannot be rested they can at least be refreshed, and anything which can be done in this way will be of real benefit to the formation with which one is serving. Incidentally I found that this attitude fostered good relations between the Field Ambulance and other units, and ensured that they in their turn did what they could for us. The R.A.M.C. are unlikely to resent any apparent pampering of the drivers, for they are quick to recognize that whilst the drivers must maintain their vehicles we must maintain the drivers. They will not in any case be long on active service before they realize how much we depend on the R.A.S.C. not only for the efficiency of our units but for our own personal comfort. With good drivers and sound convoy discipline the rations always arrive on time, we get to our new location before nightfall and can shake down in our billets or bivouacs confident in the knowledge that the cooks lorry has arrived and that dinner is cooking, and that we will not need to get up tomorrow an hour or so too soon in order to let the transport get ready for the day's move. The list of our dividends for anything we invest in fostering good transport work could be considerably extended.

Whilst he is looking at the transport the new C.O. may study the loading tables, and the method of stowing the loads on the various vehicles, which must allow essentials to be readily got at at all times and especially when on

the move. The essential things for the function of the section which uses the lorry are loaded last so that work can continue up to the moment of raising the tailboard. I do not propose to give sample loading tables, as it is best for each unit to work out its own. Unless the loading tables are basically unsound it will be best to avoid the confusion which would result from changing them. During the war there was a tendency for Field Ambulance transport to be overloaded partly because transport was apparently allotted to these units according to the weight of equipment to be carried without considering its bulk, and without any recognition of the fact that Field Ambulances had to carry many things in addition to their official equipment, such as part of the divisional reserve of stretchers and blankets, latrine seats and screens, extra rations for staff and for patients for a varying number of days, and a reserve of petrol and lubricants for one or even two hundred miles if so ordered by formation headquarters. During winter campaigns they had to carry two-man bivouac tents, extra blankets and warm clothing, heating stoves and their fuel. It might be remarked in passing that two-man bivouac tents if folded and placed under the feet of those in the front seats are as good as the sandbags often put there for protection from splinters in mine accidents. These extra loads have to be carried by other units, but their case is hardly parallel to that of Field Ambulances which have to provide for their patients as well as for their own men. In any case infantry battalions were often not expected to move in their own transport, whereas Field Ambulances were expected to do so. In addition to extra things which a Field Ambulance may be ordered to carry there are many things which they must accumulate if they are to be really efficient, such as day and night signs, and welfare and Red Cross supplies for both staff and patients—e.g. boxes of books and wireless sets. As units vie with one another to provide luxuries for their patients these things tend to accumulate, and the C.O. must be ever watchful against an undue accumulation of luxuries.

For the Sections and for each part of the A.D.S. detailed plans and loading tables should be prepared for moving with a limited scale of transport, so that, for example, in an advance in which only small vehicles such as jeeps or 15 cwt. trucks can be got across temporary bridges or in which part of the unit may have to use animal transport, or in a withdrawal in which vehicles have to be abandoned, the essential things can be carried forward and non-essentials can be relegated to a B Echelon, or jettisoned. An Appendix to Standing Orders containing orders for a move by rail or ship, and showing the cubic capacity of the equipment, is a useful precaution against a sudden move.

LIASION WITH NEIGHBOURING UNITS

During the first few days the new C.O. should visit Divisional Headquarters, Headquarters of the Brigade Group to which his unit is affiliated, and the C.O.s and medical officers of all its units. The C.C.S. which normally serves the Division should also be visited, as it is essential to keep in close touch with both the administrative and the technical staffs of that unit. It is pleasanter

all round if the two units can deal with complaints themselves, rather than let A.D.S.M.S. and such-like people find out about them; and if relations are cordial there will be no hesitation on either side about making complaints or suggestions and acting upon them. It is important for the Field Ambulance to ensure that the type of early treatment given in its Dressing Stations, whilst in accordance with the directions of the Consultant Surgeon of the Force, also takes note of any personal preference of the C.C.S. surgeons. Neighbouring general hospitals may be visited as Field Ambulance officers may want to attend there to brush up their clinical knowledge, and other ranks to obtain higher nursing qualifications. Of course, unless the Field Ambulance is part of an Independent Brigade Group, this training would probably be arranged by the A.D.M.S. The standard of training of the Field Ambulance is of vital importance to the Brigade Group, and the Brigade Commander and his staff. C.O.s of units seldom need much encouragement to take an interest in our work, and to give us what help they can. They can include problems for the Field Ambulance in their own exercises, and can provide umpires or observers for purely medical schemes, on which the opinions and criticisms of our potential patients are often illuminating. They can also lend us lecturers and instructors, and arrange for our men to attend local courses, in such subjects as chemical warfare, passive air defence, physical training, pay clerks' duties, fieldcraft, and the construction of an assault course as part of the hardening-up process for active service.

The Field Ambulance C.O. can reciprocate by helping in the training of regimental medical officers and stretcher bearers, and perhaps under the direction of the D.A.D.A.H. of the sanitary, water duty, and antimalarial personnel. The R.M.O.s should attend a fair amount of the Field Ambulance training, and must not be forgotten in connexion with any refresher courses in General hospitals. The more they know of the work of the Field Ambulance the better, for they must be regarded as part of our team. We must give them help in battle, if necessary without waiting to be asked for it, and must relieve them when they need a rest.

I consider it to be important that the O.C. Field Ambulance should control the training of regimental stretcher bearers, and be responsible to the Brigade Commander and A.D.M.S. for ensuring that there is as large a trained reserve as possible, and never less than 100 per cent. If R.M.O.s are regarded as members of our team they will not resent the control of this training by the O.C. Field Ambulance, as S.M.O. of the Brigade Group, and of course the Field Ambulance can help a lot by lending experienced R.A.M.C. N.C.O.s to help with the training done in the Battalion itself. The training of these men should include at least a week's attachment to the Field Ambulance, as this gives them an insight into our work. During active operations when wastage of regimental stretcher bearers was heavy it was sometimes the best plan to train reliefs in a seven to ten day intensive course at the Field Ambulance. If we are to achieve our 100 per cent reserve it will be essential to put many more under training, so that a searching examination may be held at the end of the

course. If a list of those who pass this test, and even more important, of those who fail, is published in unit and Brigade orders, all ranks will realize that their stretcher bearers are properly trained men, and not, as is too often the case, merely a lot of misfits detailed for this responsible job as if for potato-peeling. This has a good effect upon the morale of the fighting man, and an equally valuable effect upon the morale of the stretcher bearer's themselves. The nature of a regimental stretcher bearer's job makes him a likely candidate for war neuroses ("exhaustion"). Their physical fatigue may be extreme, as anyone knows who has carried stretchers, especially in mountains. They are always dealing with casualties, many of whom may be their friends. They are exposed to fire without the elation of combat or the satisfaction of retaliation, and they cannot throw themselves to the ground when carrying a patient. All this gradually gets them down, and it is important that any further factors which might push them towards "exhaustion" should be eliminated. Amongst the many factors which predispose to that group of conditions is a lack of self-confidence, a feeling of being a square peg in a round hole. Men who are put to jobs for which they feel themselves to be untrained mistrust themselves, and, even worse, they feel that their comrades mistrust them. Sound training and searching tests of efficiency help to remove this factor. It might be thought that a better solution would be to provide fully trained R.A.M.C. men for regimental stretcher bearers, which has been suggested. However another potent predisposing factor in the genesis of war neuroses is a lack of *esprit de corps*, and of that family spirit with its confidence in and affection for his comrades, which enables a man to subordinate his personal instincts of self-preservation to the communal resolution to face danger and to preserve the good name of the regiment. R.A.M.C. men "attached" to a Battalion might lack this important sustaining spirit, unless they were attached to the same unit for very long periods. They might for this reason be as liable to suffer from exhaustion as were reinforcements sent into battle before they had been accepted into the family of the battalion, and absorbed its pride and traditions.

O.C. Field Ambulance must also ensure that every officer and man in the Brigade has some knowledge of first aid, with special emphasis on the arrest of Hæmorrhage and the prevention of shock. This is especially important in armoured, airborne and commando units.

In Armoured Brigade at Alamein we had a leaflet, which is reproduced below, exhibited on every Company and Squadron notice board and pasted inside every vehicle. After the battle I was able quite sincerely to say that many of our casualties owed their lives, not to the medical services alone, but to their comrades.

PREVENTION OF SHOCK IN WOUNDED OR BURNED MEN

Wounded men die on the battlefield from BLEEDING, and later on from SHOCK—a condition of collapse due to the wound or burn.

Lives will be saved if not only the medical services but EVERY MAN FROM FIRING LINE TO C.C.S. act as one team to PREVENT SHOCK.

Main causes of Shock are : BLEEDING. COLD. PAIN. FEAR. so prevention must include the following measures :

BLEEDING

STOP THE BLEEDING AND REPLACE FLUID. All ranks should be taught how to stop bleeding. All wounded men need lots to drink—hot and sweet if possible. This is very important in Burns.

COLD.

A wounded man may feel cold even on a hot day when you feel hot. KEEP THEM WARM, with blankets, groundsheets, etc.

PAIN

Morphia given by M.O.'s orders—a comfortable position and CAREFUL HANDLING will help.

FEAR

Wounded men dread being hit again, or being roughly handled. Handle them with great gentleness ; make them feel that they are safe and in good hands, and you will help to prevent shock.

ALL NURSING ORDERLIES AND REGIMENTAL MEDICAL PERSONNEL *WILL* KNOW THESE RULES BY HEART—if combatants do so too they will help us to SAVE LIVES.

ORGANIZATION FOR TRAINING : AND GENERAL CONSIDERATIONS

Right from the start the proper organization of the unit for its function in battle should be shown on a notice board in the information Room, in the form of a large diagram to which can be added the names of individuals as soon as they have been allotted to their jobs. Diagrams of the unit in the order of march for various kind of moves, and of the layout of the A.D.S. should also be shown. If training is done in groups sufficient periods must be given to the Section officers for training their Sections and learning to work with them ; and Sections especially should be formed as soon as possible.

After a period of training when one has been able to observe men's capabilities classes can be formed for various types of specialist training. Ordinary technical training based upon standard courses of instruction for nursing orderlies will be going on all the time, with special emphasis on arrest of hæmorrhage, prevention of shock, fractures, burns, medical and surgical nursing in the field, war wounds, and bandaging. Every nursing orderly in the unit must have a fair knowledge of the technique of blood transfusion, and as many as possible should be highly trained in this subject.

Even if the unit is well provided with good clerks it is useful, if time allows, to train as many suitable men as possible in clerical duties, so that one can temporarily replace casualties as they arise. In all dressing stations and casualty collecting posts during battle nursing orderlies with some clerical ability can be of immense value to M.O.s, in completing Field Medical Cards, and A.F.s W. 3210. It is also useful to lend men with such training to hard pressed Regimental medical officers, and this may ensure that one receives their casualties properly "documented." Especially intelligent men may be trained as intelligence clerks, to be able to read maps, operation orders, and intelligence

reports, to mark locations, Brigade and Divisional boundaries, routes, etc., on to talc map covers, and to encode and decode wireless messages. Not only are such men of great value to the C.O. and to Section officers, but the A.D.M.S. may appreciate the loan of a well-trained intelligence clerk. I found it to be a good plan to provide a well trained medical orderly with a first-aid kit for Brigade H.Q. During training it is important to be on the lookout for men with a gift for path-finding, navigation, and map reading, and to train them as ambulance orderlies which is an important and responsible job.

In every unit there are sure to be men who seem to be unteachable, but whether the cause be stupidity or lack of interest one must try to discover and if possible to remedy it, for it is one's duty to the soldier to teach him, even if he be unwilling. Important though the specialists are, however, we must not overlook the many uses of those whom we may be driven to regard as "Congenital G.D.O.s."

Many duties which make a great contribution to the comfort, well-being and efficiency of the unit can be entrusted to the G.D.O.s, and one must study their interests and aptitudes just as carefully as those of the potential specialists. Few Territorial Army units before the war were without their almost hereditary sanitary men. These Sons of Dan would have been outraged had they been denied the privilege of spending their annual fortnight in camp in charge of the latrines. G.D.O.s can be trained in the construction of drying rooms, ablution places, and various sanitary structures. Others can be trained to run officers' and serjeants' messes, and to act as cooks' assistants or as batmen. Anthony Armstrong in his definitions of military life, under "Officers" said "See Batmen," and under "Batmen" "Without these there would be no officers." The term "Officer's Servant" should, I think, NEVER be used, and although "batman" is traditional, I think that "orderly" which was largely used in the Indian Army, especially for the "C.O.'s Orderly," is by far the best title. Especially in wartime, when men join the Army with a high sense of purpose, I feel that a soldier would prefer a title which conveys some suggestion of how useful he can be in battle as a runner and general assistant. It has moreover a military ring about it, and does not imply the status of a valet.

If the unit has not just been raised but has already been trained or even tested in battle, the new C.O. will have to study the lines on which it has been trained, and if these differ from his own ideas, he must decide whether to adapt himself to methods which are not his own, or to make changes. There are more ways than one of achieving the same object, and frequent changes may make men feel that there is a lack of definite purpose in the command. It is therefore advisable, if changes are necessary, to make them gradually, and as a result of experimentation during training, and if possible after free discussion with all ranks of the reasons for making them.

According to the time available before the unit is likely to be involved in action, and according to the new C.O.'s estimate of the state of training when he takes over, he will decide upon which subjects to concentrate, either

as revision or as new ground, and will have a training programme drawn up.

The construction of a good training programme in which lecture room work, educational and semi-recreational subjects, field exercises, and physical exercise, games, marching, etc., are well balanced, is quite a work of art. It is important to enlist the assistance of as many lecturers as possible from within the unit, and to get members of the Divisional and Brigade staffs, and of other units, to give lectures on their own subjects, so that monotony is avoided.

Training is the C.O.'s personal responsibility but he may confine himself to writing a directive embodying his ideas on the training to be done, and may leave the hack work of working out the training programme to an officer whom he may appoint as Unit Training Officer. Indeed at first he may be driven to this course by his own ignorance of the potentialities as instructors of his officers and N.C.O.s, until he has personally supervised their work.

Certain subjects must be taught to officers and N.C.O.s by the C.O. himself, or by other experienced officers and N.C.O.s ; but in general the best method of training them is to make them responsible for the training of their men, under the close supervision of the C.O., and guided by him at frequent discussions of the methods to be followed.

Constant repetition of important points is very necessary if they are to become second nature to the average soldier, and frequent periods for revision and recapitulation are advisable, and "quizzes" at which the C.O. and other officers can estimate how much progress is really being made, and which men need special coaching. However well officers and N.C.O.s may lecture, the results will be disappointing if they do not make constant use of questions, and have quizzes, for these usually reveal that one has failed to drive home some point to a fair proportion of the audience. The individual and collective training of the unit can best be assessed by asking questions at a series of simple schemes in which various forms of medical post are set up, and different kinds of imaginary casualties treated, and imaginary tactical situations created. "Quizzes" and revision periods can be included in a list of "wet weather alternatives," which can be shown on a numbered list, and so laid on quickly when a sudden change of weather calls for a change of programme.

A most important prelude to a period of training is an address to all ranks on the objects of training, which should if possible be followed by free discussion. Up to two hours may well be given to this meeting since it is most important that everyone should know what the main objectives are, and why they are worth attaining. If the new C.O. has decided that there are certain weaknesses he should explain why these are worth remedying, and he may with advantage prove that they do in fact exist by asking questions. If my experience is at all common he will often not get correct answers even when some apparently simple questions are thrown open to the whole audience. What must be explored at this meeting is not technical knowledge of nursing, first aid, etc., which can best be measured at a quiz or revision period, but the extent of general military knowledge, without which men cannot be reliable members of a

field unit, which has to play an intelligent part and to display initiative during active operations. The questions should therefore deal with the composition of a Brigade and of a Division, how they are commanded and administered, and how deployed for battle ; with the titles of the principal staff officers, the names and even the descriptions of the present holders of such appointments, and where they are normally to be found in battle ; with unit signs and with the rank badges and distinguishing flags, etc., of Brigade, Divisional, Corps, and Army Commanders. To justify expecting a knowledge of all this from every private soldier it may be explained that, however carefully plans may be made, the inevitable confusion of a battle, enemy reactions and unexpected situations, often call for the most junior soldier to act on his own, whether because of casualties amongst his seniors, because he is lost or because he is an ambulance orderly or a driver, who often has to play a lone hand. Every man must therefore know where to report important occurrences and where he can obtain advice, information or assistance, and, if he is not unnecessarily to become a casualty, he must know how to find his way around a battlefield, which he cannot do without some basic knowledge of the formations engaged. Here too one might drive home the lesson that the sometimes almost fanatical insistence of higher commanders upon their cars being recognized and saluted by all ranks, and especially by sentries, springs, not from any mere lust for the outward observances which are due to their rank and appointment, but from the knowledge that a soldier who is so unobservant as not to realize that his General is driving past him may just as easily fail to see an enemy scout-car, or may fail to observe some small sign the reporting of which might avert disaster.

Open discussions on training with a maximum attendance from the unit should be held frequently during the training period ; and not less than monthly. At these discussions, and indeed throughout all the training, the C.O. may be unsparing in his criticisms of mistakes, faulty methods, and errors of judgment—provided that he can fully justify his criticisms, and can explain his reasons for recommending better methods. I would emphasize the word “discussion.” It is free thought and debate which are wanted, not a monologue from the C.O. Officers and N.C.O.s who have been criticized, and who have perhaps been thinking things over and want to justify their own point of view, must be given free rein, even if the impression might be given that the training is in the hands of a military soviet. It certainly keeps officers and men mentally alert if they know that their mistakes will be corrected with some publicity ; but the manner of doing so must not transgress our unwritten law forbidding anything in the nature of a public slight to an officer or N.C.O., to say nothing of the positive prohibition of public reproofs which is contained in King’s Regulations. Most of us can be jolted into learning a lot more from a teacher whose methods are positive and soldiers will bestir themselves to increased mental activity if treated with some measure of genial severity. War is a brutal trade and the apprenticeship for it cannot afford to be too gentle. It is surely better for officers and N.C.O.s to lose face during

training than to lose lives during battle. Any hard feelings or unhappiness which such methods might otherwise cause can be avoided by frequently emphasizing that all of us are learning this business of war TOGETHER, and to some extent by trial and error during exercises, etc. It should be insisted that anyone who disagrees with the ideas or methods of those in authority from the Commanding Officer downwards, should speak up, and be prepared to defend his views, which, if they cannot be shaken and proved to be unsound, may even become the accepted policy of the unit. This attitude is very good for the C.O. himself, since if he willingly lays himself open to attack and cross-examination, he must keep "on his toes," and be perpetually examining the soundness of his views, and the reasoning on which they are based. Another good argument for letting everyone feel that they have a share in shaping the policy of the unit on how it will discharge its functions in battle, is that men will never feel that they are being asked to do unnecessary things or to incur avoidable risks. Once the methods are established everyone must understand them intimately, so that in the "fog of war" one can make reasonable deductions and forecasts of how officers and men left on their own will probably be acting in unforeseen circumstances, and can fairly expect of them a coherent report of what they did and why they did it. Of course any such standardization of methods must not be attained at the expense of the development of initiative. I believe that in the German Army, however blind may have been its devotion and obedience, it was regarded as a graver offence to do nothing than to do the wrong thing. Napoleon said "If success in Battle could be achieved without taking risks, Glory would be at the disposal of very mediocre talent." If one includes in one's Standing Orders a section on duties in active operations it should be stated that this is not intended to cramp the development of men's powers of initiative.

Another valuable way of encouraging men to use their brains is the writing of essays on subjects connected with the unit's role in war. Such essays should be a compulsory part of the training of officers and senior N.C.O.s; whilst for corporals and privates a competitive essay for money prizes is a useful device which not only produces many valuable ideas, but is often of great value as a guide to the selection of really good young N.C.O.s. Training plays in which one illustrates the right and the wrong ways of doing things, afford light relief during training, and give men who have a taste for amateur theatricals a useful outlet. One must be careful in these plays not to overdo the "wrong way," lest that should remain as the enduring impression, which was a special danger in connexion with chemical warfare training in which so much was apt to be learned parrot fashion. This danger can be avoided by writing a part for a commentator who breaks in from time to time during the action of the play to explain the lessons brought out by it.

We come next to a consideration of some actual training methods, after a lengthy preamble which may appear to many to be too long and platitudinous. It does, however, include many things which I have not yet seen in print, and which I believe may be of value.

III.—TRAINING DRILLS

“Now, in Drill the first thing you must never forget to remember is always to step off with the RIGHT FOOT, which is the LEFT FOOT.”

With this admonition a somewhat puzzled squad of Gaelic-speaking pipers was launched upon its military career by a very highland pipe-major. Whether it helped them to become better pipers is arguable, but nevertheless the soldier's first steps in learning his trade are traditionally and very properly in the form of drill. The soldier before joining a field unit will have had plenty of squad drill, and a weekly parade, plus the normal morning roll-call parade and parades for lectures, etc., are enough to keep him practised in this. This amount of ordinary drill may best be taken as a minimum requirement, since one must not forget the value of occasional drill parades in the maintenance of a high standard of discipline, without which even a well-trained unit can degenerate into a gang of toughs. Anyone who thinks that a crowd of undisciplined desperadoes might have its uses in war might well consider the comment of a serjeant-major of the Coldstream Guards with whom I discussed this point in the Western Desert in 1941 in connexion with the very high standard of “spit and polish” enforced in the Guards at a time when many units were sliding towards that final state depicted by “Jon” in his “Two Types.” The serjeant-major, comparing the Guards with certain units whose fighting successes were as undeniable as was their tendency to lax discipline, said that these troops might be excellent in attack—and so were the Guards—but to be steady in defence, and even in defeat, demands discipline of the highest order.

During the last war the modern conception of drill was considerably broadened, so that it no longer consists of mere automatic “square bashing” and parade-ground manoeuvres, valuable though these may be in the inculcation of discipline. Modern drills, of the type known as battle drill, aim at putting the soldier through the stages of various kinds of operations in a methodical manner, and at teaching him by repeated practice how to act in certain circumstances, so that his reactions become automatic, his actions on the battlefield governed by a series of conditioned reflexes. Thus they aim at ensuring that the stupidest man shall not forget the basic principles but shall do the right thing almost instinctively. Much of the ABC of Field Ambulance work can be taught by drills which aim at covering almost every detail of every possible kind of job which a Field Ambulance may have to do, and at ensuring that essentials are not overlooked, whilst at the same time endeavouring not to cramp imagination and initiative. A consideration of some of these drills may suitably begin our more detailed study of Field Ambulance training.

Some subjects which can be taught in this way are knowledge of the Field Ambulance panniers, tactical loading of Field Ambulance equipment in various kinds of transport, handling of various kinds of casualty, and the laying out and running of medical posts of all descriptions. Once a unit has acquired the drill habit there are few tasks in the preparation for which a useful drill cannot be elaborated.

PANNIER DRILL

Thorough knowledge of the contents of Field Ambulance panniers, companions, and haversacks, and of exactly where each thing is to be found, and ability to find them quickly and in the dark, are first essentials. Officers must know what is in the panniers ; N.C.O.s and men must be able to produce these things quickly.

Early stages consist in unpacking, laying out, and repacking all the contents, and learning about their use. The quartermaster may dislike this practice, as he is apt to be more concerned with keeping his eggs intact than with the art of making omelettes. Although his jealous care of the equipment is prompted not only by pride in his work but by thought for the C.O.'s interests, he must not be allowed to impede training, which demands that every nursing orderly shall know intimately every article of equipment by sight and feeling. Next, instead of going through the entire pannier, individual items are asked for and must be found quickly. This stage can be made slightly more interesting if men are made to learn the various places in which the same thing, such as a packet of compressed wool or a bottle of morphine, is to be found. At this stage too they may learn about the various special preparations which a keen unit usually makes in readiness for an action, and if action is imminent they may assist in preparing such things. Home-made pre-sterilized dressings of various sizes ready packed in cigarette or tobacco tins were found to be very useful. They may consist of a swab for cleaning the wound, gauze or lint for the dressing, and a pad of wool to cover it ; and if the tin is sealed with elastoplast strapping this can be used to fix the dressing on the wound. Cigarette tins filled with sterilized vaseline-gauze are useful. Morphine solution can be prepared in rubber-capped vaccine bottles, and widely distributed amongst panniers and haversacks, to supplement the normal AF. I 1248 scale.

Finally one should describe everything which a medical officer would need for various operative procedures, such as infusions when he has to cut down on a vein, the passage of a catheter, etc., and see how quickly these things can be found in the panniers, and neatly laid out. In teaching "tray setting" it is useful to draw diagrams on jaconet showing each thing in its place, the advice of a nursing officer will be helpful in this subject.

At this stage any readjustment in the packing of the panniers, which may be found necessary in the interests of efficiency, should be made, even if it permanently disturbs the separation of the AF. G 1098 and AF. I 1248 scales of equipment. For example, if one wanted to wash one's hands two panniers had to be opened, as the basin and towel were Ordnance supplies, and the nail-brush was in the AF. I 1248 scale.

Repetition of various actions until they become automatic is the essence of drill, and so much monotonous repetition of this pannier drill is needed before detailed knowledge of the contents becomes instinctive that steps must be taken to maintain interest and to eliminate boredom. Two sets of panniers can be used and competitions arranged between members of the same or of different training groups, in speed of unpacking and laying out the contents,

and in finding specified items. Individual competitions for prizes can also be organized. Officers with imagination and some knowledge of war wounds should describe battlefield incidents, how the resulting injuries would be treated, and where the things needed would be found. Since it often happens that things must be found from the panniers in a hurry and in complete darkness it is very useful throughout this training to have a period at each drill in which men find things whilst blindfolded. In this way their sense of touch, which is often very well developed in skilled manual workers, can quickly be improved to an astonishing degree.

LORRY LOADING DRILL

The rapid loading and unloading of all lorries carrying technical equipment so that they may speedily depart on a task and be ready to function immediately on arrival is an obviously necessary drill about which little need be said. Most units become very proficient in this drill, and it is, as I have said already, advisable to let Sections work out their own tactical loading tables. They should make their men learn these by drill, which it is advisable to have done in silence as any parade ground drill would be done. Also, it is useful to have the locations of the things clearly painted inside the lorries. Here one might mention the desirability of not keeping all the officers' mess equipment and welfare equipment with Headquarters. A proportion of these should be added to the Section lorry loads, so that the officers in the forward area can at least eat in comfort and the men can have a wireless set, packs of cards, and perhaps a football.

SHELTER PITCHING AND A.D.S. LAYOUT DRILL

The first step towards efficiency in setting up an advanced dressing station or any medical post is ability to pitch and strike the shelters or tents in use with great speed. During the last war the types of shelter and unit's methods of pitching them and of adapting them for use varied greatly. In one unit, for desert warfare, we used an excellent adaptation of the 30 ft. x 30 ft. tarpaulin in which tubular steel from Salvage attached to the lorry replaced the assorted "goal-posts" then in use by most units. A drill was worked out by which the shelter could be pitched or struck, the latter case including stowage of the tarpaulin on the roof of the lorry where it was battened down under the lorry's own canvas top, in the highly creditable time of three and a half minutes. Teams in Headquarters to whom extreme urgency did not apply, as it did to the Sections, were allowed four to four and a half minutes. Details of this adaption and of the drill are not given here because, although the 30 ft. x 30 ft. tarpaulin is still included in the A.F. G 1098 scale of Field Ambulances, it is better that units should adopt their own methods of pitching it and evolve their own drill. Further it is probable that our method is now obsolete as the tarpaulin will in future be used in conjunction with the penthouses (Shelters. Portable Nos. 11 and 14), which we did not possess. At the end of the war most units were using the 40 ft. x 40 ft. shelters, which they much preferred.

Using our shelter pitching drill, and a drill which we evolved for rapidly laying out the M.D.S., as it was then called, in the desert, we were able to have the whole dressing station pitched, with its signs out and so on, in eight minutes. By that time many other preparations were well under way and we were ready to work in twelve to fifteen minutes.

A standard layout for an A.D.S. on a tent or shelter basis in open country is very useful, and was quite essential in the desert, where at maximum dispersion of 200 yards it could cover a square mile. If the A.D.S. is always laid out in conformity with a geometrical plan which is known to all ranks and prominently displayed on unit notice boards it not only ensures that members of the unit and of the formation soon learn how to find their way around it by day and night, but it saves a lot of time in planning the layout at each new site. In my own desert field ambulance the medical part of the A.D.S. was a circle, the centre of which was the cookhouse; and the administrative lorries occupied fixed places outside this circle. The officer responsible for siting the A.D.S. had therefore only to make a general survey of the ground available, mark the centre with a flag, and wait on the track until the convoy arrived, when he indicated the flag, stated the degree of dispersion if this was not already known, and watched the lorries drive to their appointed places on the well-known plan without further orders. This applied to moves in ordinary road convoy formation. If driving in desert formation the lorries were already in their proper positions, driving over the open desert in such formation that wherever they halted they were in the correct shape of the A.D.S. This gave the C.O., standing up in his car with the whole desert almost as far as he could see alive with his vehicles bucketing over the sand, a delightfully nautical feeling as of the commander of a flotilla at sea.

From the moment that the convoy arrived at the site and the cookhouse lorry drew up at the centre of the circle, series of co-ordinated activities began, and these also must be incorporated in and practised continually in this layout drill. Special men travelling on certain convenient lorries must have tasks allotted to them. Thus men drop off the lorries which will be close to the entrance and exit with signposts which they erect, and with picks and shovels to smooth out or prepare the tracks into and out of the site. Others start to dig slit trenches, to camouflage the vehicles, to prepare stretcher beds and dressing trays, to sign the various sections of the A.D.S., to brew tea, and so on. All this is included in the drill and each task is done always by the same man so that no shouting of orders is needed.

The vital importance of good signposting is very widely recognized, but it was in the desert that one saw most clearly the value of putting out signs immediately on arrival at a site, even before the post was ready to function. Men covered great distances in a day and all the time they were almost unconsciously storing away visual impressions of the few landmarks in that featureless country. If they passed a medical post whilst it was being set up and saw no Red Cross sign they would be convinced for the rest of the day that in that stretch of country there was no functioning medical post; whereas the Red

Cross sign would have done its work and they would have been able to spread the news wherever they went.

At all A.D.S. layout drills pack store procedure should be practised, and it must be known to all N.C.O.s not only to those of the Quartermaster's department. In fact it is desirable for all Field Ambulance personnel to have some knowledge of the regulations in force about the disposal of the personal kit and valuables of casualties, and to realize that even in the stress and confusion of a battle careful attention must be paid to this, since, however expertly we handle our casualties in every other way, the reputation of the unit will suffer from carelessness in dealing with their belongings. Since it is obviously important for members of a field unit to be as interchangeable as possible, and to have understudies available to replace casualties, it is also useful at these drills to explain the normal clerical procedure and the use of A.F.s W 3118, 3210, A.B. 27A (revised), and any special cards or labels in use for special types of injury. Detailed instruction in the preparation of these documents need be given only to officers, clerks, and men of good standard of education who are suitable for training as clerk orderlies, a type of assistant who can be invaluable to busy M.O.s at R.A.P.s, C.C.P.s, and A.D.S.s in battle.

A subdivision of the drill for laying out the A.D.S. is a drill to teach the various procedures which take place there. This includes reception of the case, a quick appreciation of the best disposal of him, his proper "documentation," and removal to the appropriate section of the A.D.S. Initial instruction in this can be given in the lecture room by showing on a diagram of the A.D.S. to which part of it different types of case would be sent, and how the best use can be made of the ambulances bringing cases; with a description of documentation and of the method of dealing with kit and valuables. Next N.C.O.s and men should be brought to the blackboard and given envelopes containing slips of paper describing various types of case, or A.F.s W 3118, the proper preparation of which can be made a part of the exercise. Each envelope full of imaginary cases represents an ambulance arriving at the reception department, and the N.C.O. describes how each would be dealt with. Later, when laying out the A.D.S. has been speeded up so as to leave plenty of spare time at such parades, this reception procedure will be practised with ambulance loads of "casualties," who will be documented and distributed to the appropriate sections of the A.D.S. Proper use of the A.F. W 3210 must be practised and the C.O. should satisfy himself that the A.D.S. clerks know at any time how many cases have been dealt with, and how many await evacuation in the various sections of the A.D.S.

The type of test exercise which may be set is as follows :

(a) *Question* : An ambulance load of surgical cases, all minor wounds well dressed at the R.A.P. and with no blood soaking through the dressings, arrives whilst the A.D.S. is working under pressure.

Answer : Document them in the ambulance and send them all direct to the evacuation section where any who later seem to need attention can be seen and re-dressed, unless a convoy is almost immediately leaving for the C.C.S., when they should be sent with it.

The lesson to be stressed here is that unnecessary re-dressing or examination of cases wastes time and dressings—the supply of which in the forward area must always be carefully conserved—and may increase any wound shock from which the cases may be suffering, as well as delaying their evacuation.

- (b) *Question* : One serious case with an abdominal wound and six slightly wounded cases.

Answer : Take the sitting cases out of the ambulance at once, and let them wait in Reception, later to be documented, treated if necessary, and sent to the evacuation section.

The ambulance will go at once to the resuscitation, or major treatment section with the serious case, accompanied by a clerk or orderly to ensure his immediate reception, and to do the documentation, and return to the reception section with his A.F. W3210 (original).

- (c) *Question* : Two cases with gunshot wounds of the thigh, in Thomas splints applied at the R.A.P., and four sitting cases with minor wounds whose dressings have not been changed for several hours, and who complain of some pain or discomfort.

Answer : Document all cases in the ambulance, and send the ambulance first to the major treatment section with the two serious cases, and thence to the minor surgical section with the others.

- (d) *Question* : Three cases of infective hepatitis, one case with suspected effects of a lung irritant gas, and one with a gunshot wound of the jaw.

Answer : All documented in the ambulance, which then takes them first to the minor surgical section for the medical cases, and thence to the dental section.

This answer conforms to our practice in the layout which we adopted in the desert, in which the same shelter was used for minor surgical and medical cases. The dental section was either with or close to the major surgical section. The titles given to the various sections of the A.D.S., and the nature of the work done in each will of course vary somewhat in different units. Whether cases such as those of infective hepatitis in the last example would be sent to the minor surgical and medical section would depend on the degree of congestion in the evacuation section, and also on how soon the next convoy was expected to leave for the C.C.S. Another lesson to be brought out is that if the A.D.S. has a special section for gas cases it is for the effects of vesicant gases only. Cases of exposure to lung irritant gases are urgent lying medical cases. The extent to which one removes cases from the ambulances at the reception section depends upon various factors such as the extent of country covered by the A.D.S., and the rate at which ambulances are arriving, since one cannot delay them too long at the main entrance if it means causing congestion there. In a desert A.D.S. it was common practice to examine cases in the ambulances and to send them to the various parts of the extensive camp in the ambulance which had brought them there. In a building in European

warfare it was more usual to unload the ambulances, and to make the first examination of the cases in the large room or hall set aside for the reception department.

ASSAULT DRILL

Under the title of "Assault Drill" I used a kind of exercise intended to teach men quickly to adapt themselves to tasks such as the crossing of small rivers, the passage of mountain barriers, or landings, etc., in which one might have to function on foot without the help of any transport, or might have to transfer equipment suddenly to a reduced scale of transport, using, for example, only jeeps or animal transport. Normally one would expect to have a period of planning and preparation before being called upon to take part in such operations, but it has happened that Field Ambulances have had to make such preparations at very short notice. It was in fact one such experience which impressed me with the value of such a drill, and I will describe it in illustration of this point.

I took a reinforced company of an Indian Field Ambulance to the assault of Mount Dologorodoc in the Battle of Keren, and when they were about to start the ascent of the steep and rocky hillside up which I had already accompanied the Brigadier on a reconnaissance, I rejoined them with the news that the mules, on which all our stuff was loaded, could not manage the climb until a track had been constructed. At the bottom of the hill in complete darkness and some confusion, and with great speed lest we should miss our place in the precisely calculated march table, we had to select essentials from our panniers and yakdons, make them up into suitable man-loads, and carry them ourselves over 1,000 feet up the hill, in more than one trip. It was this experience, incidentally, which caused me to realize the importance of and to initiate blindfold training.

It is in any case very good training and always useful to have a drill whereby the unit, or part of it, can speedily get ready to proceed on foot, or in modified or improvised transport, taking with it the essentials for its function. A high degree of elasticity, especially in the Company, is an essential characteristic of a good Field Ambulance, and is the quality above all others which makes these units so interesting to serve with.

In explaining to other ranks the value of this drill, which is always a sound thing to do, one can think of many occasions on which it would help—ranging from the problem of a section detailed to accompany part of a Brigade group crossing a river when some accident has made bridging impossible for several hours, to the ultimate disaster of the breakdown and abandonment of one's transport in a withdrawal—not of course a "retreat"—only the enemy retreats, our side withdraws. This kind of drill is best done by sections, not by training groups, and it is preferable to leave the sections to work out for themselves the essentials to be carried and the method of stowing them in packs, haversacks, basic pouches, and on such things as Everest Carriers if these are available. Section officers and N.C.O.s will be sure to discuss these points with one

another, and later if it seems to be desirable the approved method for the unit can be laid down. A preliminary short talk on the objects of the drill should be given by the Section officer who should then read out or put on the black-board a list of the things to be taken from the panniers and his ideas on how these should be carried. This can then be open to discussion, since the object is to find the best method, and those who will have to carry the loads can often help in this. All ranks must work out for themselves how they will pack their personal requirements, and it is a useful exercise to make men prepare a list of the things which they would take with them. The equipment is then quickly removed from the panniers, distributed in suitable man-loads, and its packing practised. The same should be done for various types of vehicles, and for mules or camels if the animals and the necessary gear such as universal carriers are available. When after repeated practice sections can, with great rapidity and in darkness or blindfolded, pass from a mechanized to a man-pack or animal transport basis, the drill is combined with simple exercises adapted to local circumstances. If you have cliffs or mountains near-by, a C.C.P. or modified A.D.S. will be manhandled up these, quickly laid out, and prepared for the reception of casualties, including the immediate brewing of tea, which, if the physical effort has been severe, is never wasted and provides an incentive to speed. Rivers and canals may be crossed in boats, barges, or improvised rafts, or men, equipment, and stretcher cases may be slung across narrow streams by rope and pulley, and a medical post set up on the far side. I will not describe the methods of making improvised rafts, rope bridges and so on, as these have been described in articles in this Journal. A surprisingly efficient temporary raft can be very quickly made with several armfuls of hay or straw packed in a tarpaulin, and this is often the best way to make the first crossing of a stream and to take a rope across it. If every man's work is to be economically directed during preparations for such crossings of small streams it is best, once the methods have been learned, to do them as a drill. If one has no boats, etc., to practise with one can dig in the ground a hole of the exact dimensions of an assault craft in which men, having packed their equipment into packs and haversacks, can quickly embark.

MISCELLANEOUS DRILLS

Various other activities can be practised as drills, and units should work out their own methods for these. They include the adaptation for use as dressing stations of various kinds of building, and for use in casualty evacuation of any available local vehicles, rolling stock, barges, boats, etc.

During stretcher exercises men must practise lifting casualties on to stretchers in various ways, how various types of casualty should be placed and retained upon stretchers, the use of mountain stretchers, and methods of improvising stretchers. Stretchers must be carried over obstacles, up and down cliffs, across streams, and must be placed in ambulances and in all the kinds of vehicles in use, such as ordinary load carriers, jeeps, DUKWs, armoured

personnel carriers (Kangaroos), tracked landing vehicles (Buffaloes or Neptunes) storm boats and other assault craft, Weasels, and if possible in various types of aircraft. The drill for removing casualties from armoured fighting vehicles must primarily be worked out and practised by the combatants who use them, but members of medical units must also learn about this.

Drills for casualty sweeps have been published in this Journal, but although they look convincing in a Training Programme and are useful as a training exercise, I feel that they have little practical value, since it accords not merely with regulations but with common sense that searching the battlefield for casualties should be the responsibility of the combatant commander, since he alone can judge when it should be done, and that it should be done by combatant troops with medical assistance, since the men who have fought over the ground best know its topography and its pitfalls, and medical personnel are usually less familiar with the intricacies of minefields and booby traps.

In teaching convoy discipline there are many things which should be automatic, such as action at halts or when a vehicle breaks down in convoy, the positioning of air sentries, etc.; and these should be taught as a drill. It is imperative that all members of the unit should know all about convoy discipline, which should not be regarded as the concern only of the R.A.S.C. This training may well be organized by the M.T.O. whose advice will be useful in drafting the part of unit standing orders dealing with this subject. The convoy work of the R.A.S.C. is usually outstanding and often gains kudos for medical units in formations in which efficiency in this matter is encouraged by competitions. It helps to keep convoy discipline up to the mark if on long moves in convoy the C.O. and second in command conceal themselves at points on the route and allot marks to the various sections of the unit which are later published in orders.

During the last war we had to practise drills connected with chemical warfare, such as removing cases from contaminated ground, laying out first aid and decontamination centres and treating gassed cases, and ordinary unit decontamination. In such training I found that "little and often" gave better results than intensive courses, which tended to present the subject in imperfect perspective, for there were surely no more single-minded enthusiasts than the gas experts. Most of us had our periods of intense enthusiasm for this form of training, and as it is all described in the pamphlets it is unnecessary to say any more about it here.

Fortunately the need to apply our knowledge of chemical warfare never arose, but presumably in the immediate future we must continue our study of it, until it is replaced by something else.

I will leave it to someone capable of flights of imagination to suggest the lines on which drills might be evolved for medical personnel called upon to deal with an atomic bomb incident, or with as yet purely speculative forms of warfare.

(To be continued)

THE WEEK-END HABIT

BY

Major T. W. CARRICK
Royal Army Medical Corps

THE CHANGING SCENE

The year is 1912—The time is Sunday morning—The scene is any suburban home :

Mrs. Howard sipped her third cup of breakfast tea slowly and surveyed her family of three sons with considerable satisfaction. Their suits were neatly pressed and their whole appearance suggested her own efficiency and capabilities as a housewife and mother. Shortly, they would all accompany her to church and return to that pleasant ceremony—the Sunday dinner. She looked forward to that event as today she had some extra delicacies on her menu—red currant jelly for the saddle of mutton and extra special cream for the apple pie that was to follow.

The rest of the day she also anticipated with pleasure. Her husband had hired a cab to take the entire family to her sister's house in North London, where they would stay for tea and supper.

Her pleasure at this outing was increased threefold by the knowledge that her family enjoyed visiting their aunt, and meeting their cousins and their friends.

The evening would be a pleasant one for everyone, reflected Mrs. Howard, as she rose to organize the family for church.

THE YEAR IS 1948—THE TIME AND PLACE ARE THE SAME

Mrs. Howard rose hurriedly from her bed as the last peal of her new electric alarm clock died in the morning air. There was no time to waste, if she and her husband were to reach Southend in their pre-war Austin Seven before lunch. There was the breakfast to see to, the sandwiches to make for their picnic lunch and more than likely she would have to help to start the car.

Thank goodness the family were also going off for the day, and, other than breakfast, meals would not trouble her further. John, her eldest, had already gone very early for a day out with his cycling club.

Arthur and Jim were spending the afternoon at Richmond ice rink and were taking their latest young ladies to the local Odeon in the evening. Now they were both working they could afford to lunch out. Yes! Breakfast was her main worry. To brighten the morning gloom Mrs. Howard switched on the radio—she found a little music in her background helped her work. The voices of the male choir in the morning religious service were not to her mood; she quickly switched to the light programme and found the sentimental strains of the *Geisha Girl* more to her liking.

THESE two fictitious episodes serve to illustrate the change of background which has affected all but a very few of the inhabitants of this country. It is not alone the very young who have undergone this metamorphosis, but their parents and grandparents alike.

The older conception of Saturday and Sunday has gone. No longer are they days when, "the whole family are at home"—no longer are they times for family relaxation and visitation. They are days when the family, as a

unit or as individuals, is pleasure bent and carefree. "Mother's day" has changed to "holiday" and mother insists on her fair share of what pleasures are going.

This general change must be considered when discussing the effect of the week-end *habit* in any group or groups of the community.

The Army Group.—In common with all other members of the community every individual in the Army today has been changed in outlook by this altered background.

The older regular officer and regular N.C.O. has changed gradually, and has come to accept new week-end habits as he accepts his motor-car or motor-cycle. He has changed without knowing it. The young national service man, born in the late 1920's has known no other week-end than one devoted to pleasurable relaxation. His attitude is further encouraged by the present trends in social developments—shorter working hours, fixed holiday periods and increased payment for overtime work.

The Effect on the Group.—It is only too obvious that week-end freedom is a habit acquired in the family circle and in early upbringing. It is not peculiar to the Army as a group but touches all sections of the community—the professional man, the industrialist, the technician and the artisan.

What then is the effect of this new habit on the structure and function of the Army. It is accepted by most military planners that the success of any army or fighting service can be directly measured by the morale and discipline of that army or service. If one can prove that declining morale and lessening of *esprit de corps* is in part attributable to the spending of week-ends out of barracks, it may then be said that the week-end habit is deleterious. On the other hand, if this is not so, can it be said that the function of the Army is upset, whether this function be a primary fighting role or the establishment of a highly trained nucleus capable of transmitting its experience to others?

Morale, therefore, forms a useful yardstick by which effect can be measured.

The Analysis of Morale.—A prominent wartime Army psychiatrist defined the maintenance of morale as: "The satisfaction and balance in the human personality of five basic needs—Physical, Security, Competition, Recognition and Creative Activity."

Where one or more of these needs is lacking or where their balance is upset, a breakdown is likely particularly in the weaker types of personality.

Physical Needs.—Every normal personality demands four basic requirements for normal mental health—on which morale is directly dependent. These represent the necessities of life—water, shelter, food and a healthy balanced sex life. Normally the first two are provided whether the soldier be at home or in barracks and in the present argument can be dismissed.

Food may vary much. We all like a change of diet and in particular we like to escape from time to time from the unavoidable monotony of "bulk" or "communal" feeding. In this respect the week-end provides the ideal opportunity for change and, in many cases today, supplies additional calories also, made available by self-sacrificing mothers and families.

The sex life of the individual may seem quite outside the province of, and to be unrelated to, week-end custom. Yet, on considering the prevention of venereal disease, a normal healthy home background is a factor recognized by most authorities.

Better the young soldier finds his social relationships in or near the home, than among the cheap and only too obvious facilities of the average garrison town on a Sunday afternoon.

Security.—In this need the personality demands continuity and prolongation of tenure in work and recreation. It is found in its highest degree in every normal home and is expressed by the mutual trust between child and parent.

When the young leave home they experience for the first time "worldly" insecurity. This feeling is further increased by unexplained or unreasonable changes or actions. Today the young national service soldier suffers much from insecurity; often his chosen career, technical or otherwise, has been interrupted by his period of national service and he fails to offset this seeming disaster by appreciation of the facilities for broadening the personality which Service life presents.

Can we deny him opportunity for periodic return to the security of the family circle unless we can offer something more concrete in its place?

Competition.—It is in competition that the mind finds outlet for the relative power gained by experience. The demand for this may be satisfied at work or play—and it is allowed for in all aspects of Service life from the system of promotion to organized games.

Relaxation and rest are essential if the self-appointed competitor is to remain in condition—the change of atmosphere and background provided by the average week-end allows this rest.

Recognition.—In its need for recognition the personality demands satisfaction of its sense of worth—it asks for appreciation, affection and companionship. To the man who is outstanding at his work or in his play this factor is supplied automatically, to the plodder it comes slowly and sometimes not at all.

Paternal or maternal affection and pride may be the only source of recognition, from which the less brilliant and intelligent individual can draw.

A working week of comparative mental loneliness may well be compensated by a short visit to family, relatives, or friends. Such a visit will do much to satisfy this longing, no matter how good are the man management standards of the particular Army unit.

Creative Activity.—Creative activity allows opportunity for the personality to develop and broaden its outlook. The fortunate individual finds this in his normal work, the less fortunate may have to seek it elsewhere—in hobbies and recreational activity. While admittedly it behoves a well-run unit to supply and cater for the recreational needs of its members, many national service men may have made strong contacts with recreational clubs and groups before entering the Service. He will reap more enjoyment from these familiar out-

side contacts, and further they provide material for comparison and discussion in groups of a similar nature, which may be run within the unit.

Conclusion.—If morale can be accepted as a means of measuring the effect of the week-end on the function of the Army, it appears from our analysis that the total effect is one of benefit and not hindrance to the man's working capacity.

If the habit is discontinued we must be prepared to supply unit week-end activity which will fulfil all the basic needs demanded by the personality—it is difficult to see how this can be done.

Much has been done in recent months about restoring the week-end habit of peacetime—there is doubt in many minds on what this habit was.

Listen, for a moment to this actual conversation which took place recently between the writer and a regular soldier of some twenty year's service. A man who started in boys' service and who was commissioned during the war years.

Writer : What did the peacetime week-end consist of in 1930 ?

Regular Soldier : We played organized games on Saturday or attended outside matches in organized parties.

Writer : What about the people who did not play or attend a game ?

Regular Soldier : They were free to leave barracks provided they were back by 10 p.m. on boys' service and 11 p.m. on regular service.

Writer : What about Sunday ?

Regular Soldier : We attended compulsory Church Parade and after were free to leave barracks provided we returned by 10 p.m. or 11 p.m. and were granted a pass for this purpose.

It appears from this conversation that the old week-end was little different from the present week-end, except that the individual had the frustration of compulsory confinement to the barrack area.

A Final Reflection.—The changing social background of the British People has been discussed at some length. One factor which has not changed is the spirit of the people in the face of urgency or danger. A man will work well at all times, week-end or not, provided he feels that there is a need for that work and that its nature is constructive.

It is constructive, well-planned employment only which will keep the individual mentally happy during a week-end in barracks, not an air of forced gaiety and enjoyment produced by the compulsory organization of amenities.

Such employment, whether in connexion with his own training or Territorial training, must be provided if the individual is retained in barracks.

His morale will suffer if he is offered routine, badly organized, non-creative activity. It is a characteristic of our nation that we work well and hard when we are convinced, and then only, that we are well led and that the work is worth while.

EMPYEMA OF THE GALL-BLADDER DUE TO SPIRONEMA TYPHI

BY

Major J. K. B. WADDINGTON

Royal Army Medical Corps

EMPYEMA of the gall-bladder is a rare complication of typhoid fever and the case described below occurred in one of a series of twenty-seven typhoid cases in a small outbreak in a military hospital.

The infecting organism in twenty-one of these cases was of Phage type "N" all twenty-seven cases having been patients (for various diseases) in the hospital between June, 15 and 25, 1948. Suspicion as to the source of the infection lay on two food handlers whose serum showed the presence of Vi antibodies but whose urine and faeces were negative for *Spironema Typhi*.

History.—The patient, a soldier aged 20, had been admitted to the military hospital on June 20 with infective hepatitis and subsequently transferred to a convalescent depot. Whilst there he had suffered from severe headache and fever which lasted two days and then subsided.

On July 23 he was readmitted to the military hospital complaining of fever, epigastric pain and anorexia.

Clinical examination revealed no abnormality apart from a furred tongue, a tender liver and pyrexia of 100° F. and he was regarded as a potential typhoid fever.

Blood culture was negative but a Widal test on July 24 showed positive agglutination against *S. typhi* Type "O" in a titre of 1/125, his previous T.A.B. inoculation having been carried out one year before.

On July 29 he was feeling fairly well again but at 7 p.m. on the 30th he had severe upper abdominal pain causing dyspnoea and making movement in his bed very difficult. There was board-like rigidity of his upper abdomen, liver dullness was not diminished, bowel sounds were absent and his recto-vesical pouch was very tender on rectal examination. It was not possible to define the liver edge on account of the muscle guarding.

A differential diagnosis was made of a perforated typhoid ulcer, a perforated duodenal ulcer or a very acute cholecystitis and operation was advised forthwith.

Laparotomy was undertaken at 2 a.m. on July 31 using a right upper paramedian incision and free fluid presented on opening the peritoneum. The gall-bladder was under tension and was acutely inflamed and after opening the viscus a large mixed type of gall-stone some 3/4 in. diameter was found obstructing the cystic duct. Prior to opening, the gall-bladder was aspirated and thick pus withdrawn.

Cholecystectomy was performed fairly easily, the appendix which was normal was removed and the abdomen closed making provision for drainage via a stab wound in the flank.

Convalescence was disturbed for forty-eight hours but after that time the patient improved rapidly, his wound ceasing to drain by August 10 and he was evacuated to England on August 29 by which time it had been ascertained that he was not a carrier of *S. typhi*.

Culture of the gall-bladder wall, pus from the empyema and bile from the drainage tube yielded a pure growth of *S. typhi* phage type "N"

DISCUSSION

Cholelithiasis has usually been considered to be a disease of the 3rd or 4th decades, but Potter [1] reports 226 cases of gall-bladder disease in patients under 15, 140 of whom had calculi; C. Bearse [2] found that 20 per cent of operations for gall-stones were performed in patients under 30, 5 per cent of whom were under twenty years of age. The size of the stone in R. M.'s case suggests his gall-bladder had been pathological for some considerable time.

Although *S. typhi* is commonly present in the gall-bladder during the course of typhoid fever and often afterwards for varying periods, actual acute cholecystitis does not often occur and when it does it is usually in young adults. Anderson [3] considers gall-stones are rare in the acute stage of typhoid but it is reasonable to suppose that if stones are there acute cholecystitis would be more likely to supervene.

A search of the literature of the last thirty years has yielded very little information on the incidence of acute cholecystitis in cases of typhoid but, in 1934 Hillemand, Mezard and Valoise [4] described 5 cases, Potter [1] found 16 cases due to *S. typhi*, the cholecystitis being identified clinically in 1 case, by operation in 6 and by autopsy in 9. More information is to be found earlier in the century and Camac [5] collected 115 cases of typhoid cholecystitis, 4 of whom had gall-stones also, whilst other relevant figures are given in the table below:

<i>Author</i>	<i>Cases of enteric fever</i>	<i>Cases of cholecystitis</i>
Stewart [6] Montreal	620	7
Ashurst [7] Philadelphia	2,864	18
M'Crae [8] Johns Hopkins S. African Hospital	1,500	19
(Boer War 1900-01)	1,016	1

Thus in 6,000 cases of enteric fever only 45 were accompanied by acute inflammation of the gall-bladder. It is even more rare to find suppuration occurring in the acutely inflamed gall-bladder; S. de Renzi [9] described a case of suppurative cholecystitis, cholangitis and peritonitis which complicated typhoid in a child of 14 years, thirty days after the onset of the fever and Vincent [10] notes a case of a patient aged 52 who had been a recognized "carrier" for twenty-six years who at operation had an empyema of the gall-bladder with multiple stones; Fisher in 1924 found an empyema at the autopsy on a typhoid patient of 11 years whilst Hoelscher [11] performing autopsies on 2,000 fatal cases of enteric fever in Munich found pus in the gall-bladder in only 5 cases.

These figures give some idea of the infrequency with which suppurative cholecystitis does occur in acute typhoid fever though more modern methods of clinical observation and diagnosis might yield a higher rate of incidence if it does in fact exist.

During the last twenty-five years the wisdom of removing acutely inflamed gall-bladders has often been discussed in the British and American Press and every case must be judged on its merits, but the facts should be born in mind that 20 per cent of cases go on to suppuration and 25 per cent to gangrene if they are treated conservatively. When, however, the special case of typhoid cholecystitis is examined further the important question of chronic "carrier" elimination arises and cholecystectomy is pre-eminently useful in curing these cases.

Vogelsang and Boe [12] have investigated 360 cases of typhoid and 1,027 cases of paratyphoid B convalescents between 1920 and 1947 using the method of culturing bile obtained by duodenal intubation and they have found a much higher percentage of carriers remain after enteric than had been heretofore realized, the figure for typhoid being raised from 3.7 per cent to 11.5 per cent and for para B. from 3.6 per cent to 11.8 per cent.

They also found that 11 per cent of cases were temporary (i.e. up to three months after defervescence) carriers and 3.3 per cent were for life, such state of affairs being more common in middle-aged females associated with chronic cholecystitis and lithiasis.

They cured 14 out of 15 cases by removal of the gall-bladder and Saphiro [13] cured 75 per cent of his cases surgically but only 7.6 per cent by medical measures alone.

CONCLUSIONS

(1) Cholecystectomy is a recognized procedure in the treatment of acute cholecystitis.

(2) When the latter condition occurs in the acute or convalescent stage of typhoid fever, the conservative measures should be the treatment of choice but if the clinical picture shows any sign of pus formation in the gall-bladder, laparotomy is essential and one need have no hesitation in removing the affected viscus.

(3) Though acute typhoid cholecystitis cannot be regarded as an indication for surgery in the acute stage of enteric fever, such an operation is a means of ensuring that the primary site for retention of *S. typhi* is removed and temporary or permanent carrier states eliminated.

SUMMARY

(1) The case described is an example of the very rare complication of typhoid fever, suppurative cholecystitis.

(2) Whilst it was suspected that the patient might well be suffering from typhoid, the clinical findings were inconclusive and it was only after laparotomy that the true diagnosis was obtained.

(3) Stone formation in the gall-bladder of this man of 20 years of age suggests a pathological process of long duration and there is little doubt that the presence of the stone predisposed to acute cholecystitis and, by reason

of its location at the neck of the gall-bladder, led to a suppurative, obstructive type of cholecystitis with empyema formation.

(4) Cholecystectomy was performed in the acute phase because by so doing a grossly diseased viscus was removed and at the same time it eliminated the possibility of carrier formation.

My sincere thanks are due to Brigadier D. Bowie for his interest, help and criticism and to Lieut.-Colonels Hyde and R. S. Hunt for their permission to write up this case.

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Clinical and Other Notes

A CASE OF ANEURYSM OF THE ULNAR ARTERY

BY

Lieutenant-Colonel R. E. WATERSTON, F.R.C.S.

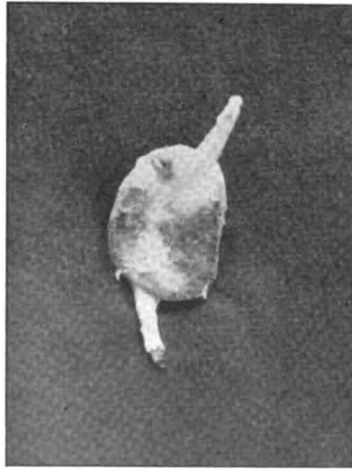
This case is reported on account of an unusual complication of a simple injury.

A soldier, admittedly unaccustomed to handling a wine-glass and while slightly intoxicated, snapped the stem of his glass and stabbed his right wrist with its projecting end. He described the bleeding from the small wound as torrential, and various attempts at applying a tourniquet were made by his friends in the tavern in Germany where this incident occurred. Firm pressure at the site of the wound finally controlled it, and he was removed to hospital.

The wound was a small punctured one, and continued firm pressure stopped the bleeding. He was discharged from hospital in about a week's time with the wound healed.

Some weeks later he noticed a slight redness and swelling in the region of the wound now soundly healed. He was on leave at the time, and an attempt was made with a needle to "let the pus out." This being unsuccessful, he went to a civilian hospital where the swelling was recognised as an aneurysm, and he was transferred to a military hospital for treatment.

When examined there was a visibly pulsating swelling in the line of the ulnar artery



Specimen of aneurysm excised at operation, showing the vessel entering and leaving.

immediately proximal to the wrist joint. Circulation in the hand was normal, and there was no audible bruit. There was impairment of sensation in the sensory area of the ulnar nerve in the hand, and some weakness of the intrinsic muscles supplied by this nerve was demonstrable.

The aneurysm was excised without difficulty, the ulnar artery proximal and distal to the sac being ligated. It was seen that the ulnar nerve which lay in direct contact with the sac had been slightly flattened by pressure. He has made a complete recovery, and the abnormal neurological signs have disappeared.

The specimen comprises an aneurysm with artery entering and leaving. The sac was tough and fibrous, and the cavity contained some clot. There was no demonstrable communication with a vein.

THE CONSULTANTS' REUNION DINNER

THE Annual Consultants' Reunion Dinner was held in the Headquarter Mess, Millbank, on Thursday, July 21, 1949.

This has become an annual event which, from the opinions expressed, has every chance of continuing its popularity.

There was a very good attendance of wartime consultants, including visitors from as far away as Belfast and Edinburgh who came especially for this reunion.

After the usual toasts the Director-General gave a short speech describing the present difficulties arising from the shortage of short service officers and the steps which were being taken to overcome these shortages. The presence of so many consultants at the dinner was, he said, a proof of the continued interest which they continued to have in the Corps and he felt that he could be certain of their assistance in the close integration which is so desirable between the Corps and the National Health Service.

Those attending the dinner were :

The Director-General, Lieut.-General Sir Alexander Hood, Major-Generals J. C. A. Dowse, F. Harris, W. C. Hartgill, D. C. Monro, Sir Henage Ogilvie, R. C. Priest, Sir Arnold Stott, Sir Letheby Tidy, Brigadiers H. K. Ashworth, D. E. Bedford, J. Bennet, E. R. Boland, G. J. O. Bridgeman, R. A. Broderick, J. Bruce, St. J. Dudley Buxton, Sir Hugh Cairns, W. M. Cameron, W. I. Daggett, A. S. Daly, F. D. Howitt, T. C. Hunt, J. W. B. James, R. Lees, F. M. Lipscomb, D. McAlphine, D. B. McGrigor, P. Miles, C. N. Morgan, F. E. Osmond, A. E. Porritt, W. Ritchie-Russell, Max Rosenheim, R. J. Rosie, A. Sachs, B. Schlesinger, Sydney Smith, A. Torrie, R. E. Tunbridge, R. O. Ward, J. M. Weddell, Sir Lionel Whitby, C. Donald, H. C. Edwards, D. Fettes, Ian Fraser, H. L. Glyn-Hughes, V. P. Hall, J. C. Hawksley, I. G. W. Hill, Colonels A. E. Campbell, W. W. Dix, Sir James Walton, S. H. Woods, H. Yellowlees, Lieut.-Colonels D. W. Bell, J. A. MacDougall, and Major H. W. Peck.

VISIT BY SENIOR U.S. MEDICAL SERVICE REPRESENTATIVES TO THE R.A.M.C. HEADQUARTER MESS, MILLBANK

(1) On Monday, August 8, 1949, a number of senior officers and representatives of the Medical Services of the United States Forces were entertained to Luncheon in the Headquarter Mess, Millbank.

(2) To meet the United States representatives invitations were accepted by the following :

Sir W. Wilson Jameson, Ministry of Health.
 Sir Weldon Dalrymple-Champneys, Ministry of Health.
 Dr. Charles, Ministry of Health.
 Sir Edward Mellanby, Medical Research Council.
 Vice-Admiral C. E. Greeson, D.G.M.S., Royal Navy.
 Air Marshal P. C. Livingston, D.G.M.S., Royal Air Force.
 Air Commodore W. E. Barnes, Royal Air Force.

The United States representatives at the luncheon included :

Dr. Raymond B. Allen, Director Medical Services Division—Secretary of Defence.
 Rear-Admiral Clifford A. Swanson, Surgeon General U.S. Navy.
 Major-General Malcolm C. Crow, Surgeon General, U.S. Air Force.
 Major-General George E. Armstrong, Deputy Surgeon General, U.S. Army.
 Rear-Admiral Joel T. Boone, U.S.N., General Inspector, Medical Department.
 Mr. Charles P. Cooper.
 Mr. J. J. Whelan.
 Lieut.-Colonel Leo Hawel, Jnr., U.S.A.F.
 Lieutenant-Commander Arthur H. Nelson.
 Colonel Earle Standles, U.S.A.
 H/MC Theodore S. Shearer, U.S.N.
 Lieut.-Colonel Dan F. Ogle, U.S.A.F.
 Lieut.-Colonel John W. Regan, U.S. Medical Attache.
 Colonel J. Gamel, U.S. Embassy.
 Lieutenant-Commander A. H. Nelson, U.S. Embassy.
 Lieut.-Colonel N. Atria, U.S. Embassy.
 Captain H. D. Hubbard, U.S. Embassy.
 Captain J. M. Bachulus, U.S. Embassy.

The R.A.M.C. officers present included :

Lieut.-General Sir N. Cantlie.
 Major-General F. Harris, D.D.G.A.M.S.
 Brigadier D. Fettes, Director of Surgery.
 Colonel A. E. Campbell, Professor of Army Health.
 Colonel W. A. D. Drummond, Commanding Q.A. Military Hospital.
 Lieut.-Colonel A.N. T. Meneces, Reader in Tropical Medicine.
 Lieut.-Colonel D. Bell, Reader in Pathology.
 Lieut.-Colonel C. Day, Reader in Army Health.
 Lieut.-Colonel J. A. MacDougall, Reader in Military Surgery.

(3) Dr. Raymond B. Allen, in an informal speech, described the visit of the United States representatives, and the Director-General replied, saying how pleased he was to have the opportunity of entertaining them all in the Headquarter Mess.

MISS S. K. CUFFEY TESTIMONIAL FUND

MISS CUFFEY has asked the P.M.C. of the Officers' Mess, McGregor Barracks, Aldershot, to convey to all officers of the Royal Army Medical Corps who subscribed to this Fund (Proceeds of which amounted to £63 18s. 0d.) and to express her very deep regret at leaving the service of the Royal Army Medical Corps.

Reviews

A TEXTBOOK OF MEDICINE FOR NURSES, Fifth Edition. By E. Noble Chamberlain, M.D., M.Sc., F.R.C.P. London: Geoffrey Cumberlege, Oxford University Press. 1949. Pp. 491. Price 21s.

A perusal of this work can only stimulate admiration for the author whose writing is familiar in other spheres of the teaching of medicine. It is a clear exposition of the subject on the plane of the trained nurse, and is broadened by the inclusion of a chapter on therapeutics. While the student is not required to memorize the context of this chapter it will serve a useful purpose in the training of a good nurse. Important dietetic measures in treatment are set forth clearly in the text, and an appendix gives details of preparation for the various accessory technical procedures commonly carried out in the course of the investigation of medical cases. A section on Functional Diseases of the Nervous System is contributed by Frederick Hopkins, M.D., also of the Liverpool School.

J. B.

THEORY AND PRACTICE OF MASSAGE AND MEDICAL GYMNASTICS. Seventh Edition. By Beatrice M. Goodall-Copestake, Hon. Fellow C.S.P. London: H. K. Lewis & Co. Ltd. 1949. Pp. 424. Price 21s.

This book is written to meet the needs of physiotherapists in the use of massage and exercises, with the theory and practice of which it deals in considerable detail. In Part 2 conditions lending themselves to such treatment are taken up systematically and brief accounts of the nature of the disease process and its symptoms are given. The book is wellnigh a classic in the field indicated in the title, and will have no difficulty in maintaining its time-honoured place in this sphere of physiotherapy. It will be found useful for training in remedial exercises for patients in convalescent depots, but it does not meet the needs of those concerned in dealing with recruits of substandard physique and those showing postural defects. It can be strongly recommended for inclusion in the equipment of units where masseurs undergo training. It contains 147 illustrations, mainly consisting of excellent photographs.

J. B.

AVIATION MEDICINE: ITS THEORY AND APPLICATION. By Kenneth G. Bergin. M.A., M.D., D.P.H., A.F.R.Ae.S. Bristol: John Wright and Sons Ltd. 1949. Pp. 447. Price 35s.

This book deals extensively with the physiological, medical and psychological considerations bearing on aviation and the health and comfort of

passengers and air crews. A final chapter on matters relating to international control of public health in so far as the relevant procedures and regulations affect travellers by air is a readily accessible source of necessary information. The book will be assured of a niche in current British medical literature on account of its range of subject matter, the compact manner in which such an accumulation of facts has been arranged and the clarity with which they are expounded. The section on psychological considerations is based on the findings of Sir Charles P. Symonds and Dr. D. J. Williams in their work on air-crew personnel during the second world war and the simple exposition of the important contribution of these workers to psychological medicine in the Services will be welcomed in the context. While one hesitates to question the authority with which the author speaks one wonders if his insistence on avoidance of the empty stomach while in the air in so far as this is based on the necessity to prevent fatigue in the crew—that it obviates air sickness is admitted—is not at variance with normal physiological mechanisms of storage.

J. B.

TEXTBOOK OF SURGERY. By Patrick Kiely, B.Sc., M.D., M.Ch.(N.U.I.), F.R.C.S.Eng., Professor of Surgery University of Cork. 1949. Pp. 1,200. With 611 illustrations. Price 45s.

The Author has produced in one volume of some 1,200 pages a comprehensive textbook on general surgery for the final year student and general practitioner. He concentrates on the clinical and has omitted bacteriology, immunology, and descriptions of operative technique as being subjects best studied in textbooks devoted to them.

The chapter on war wounds does not meet with approval. To concentrate the rules of procedure for the treatment of such wounds into a short synopsis is an impossible task and errors and omissions are inseparable from any attempt to do so. The same criticism can be applied to other war conditions dealt with elsewhere in the volume, burns for example. There is, however, a tremendous amount of valuable teaching concentrated into this textbook, largely fulfilling the purpose for which it is intended.

D. F.

GROVES AND BRICKDALE'S TEXTBOOK FOR NURSES. Seventh Edition. Revised by J. A. Nixon, *C.M.G.*, M.D.Cantab., F.R.C.P.Lond., and Sir Cecil Wakeley, *K.B.E.*, *C.B.*, D.Sc., F.R.C.S., F.R.S.E. London: Oxford University Press. 1948. Pp. 698. Price 30s.

This edition is the first to be brought out since the death of Professor Hey Groves in 1944. In tribute to his memory in the preface we are reminded that he planned the first edition in 1912. His place in the parts of the work dealing with anatomy and surgery has been taken by Sir Cecil Wakeley who has revised the subject matter to meet any changed requirements of the users. The main

emphasis of the book is on anatomy and physiology ; surgery and medicine are dealt with on more general lines. It supplies the solid foundation and a framework of knowledge, leaving many details to works aiming at more practical instruction. The joint revisers have produced a well-balanced presentation, which should maintain the strong position the book holds in student nursing circles.

The critic will have difficulty in piercing the armour of the sound teaching embodied in this book. Where a comparison of the symptoms of amœbic and bacillary dysentery is made on page 477, however, the statement to the effect that the stools of the former contain more pus is at variance with the differing pathology of the two conditions, with the appearances in the motions this causes and with what is found on microscopical examination.

J. B.

PERSONNEL SELECTION IN THE BRITISH FORCES. By Philip E. Vernon and John B. Parry. University of London Press Ltd. Pp. 312. Price 20s. net.

This is a full and well-balanced account of the application of psychological methods of personnel selection in the British Fighting Services during the war. It is planned in two parts. The first is devoted to the organization of selection, the general procedures employed, including officer selection, and the work of psychologists in each of the three Services. The second is concerned with the principles of selection, and reviews the technique of interview and testing. The value of each of the techniques employed is considered in some detail. Referring to any topic is unusually easy because of a good index. The book is well produced, and medical officers of the R.A.M.C. interested in personnel selection in the Army should find it readable and valuable.

R. R.

CARDIOVASCULAR DISEASE IN GENERAL PRACTICE. Third Edition. By Terence East, M.A., D.M.Oxon, F.R.C.P. Lond. London : H. K. Lewis & Co., Ltd. 1949. Pp. 208. Price 15s.

This book is one of the General Practice Series, and those for whom it is designed will find the information they seek readily accessible and concisely stated. The student who uses it will find much understanding. It contains some excellent diagrams of cardiac silhouettes and a variety of other simple charts. The medical examiner of young soldiers will find his recurring problem of the apical systolic murmur reduced to simplicity, for here he is told in a few lines on p. 17 " We may regard as of no importance any apical systolic murmur *when it is the sole detectable abnormality* ; one must not include in this statement the first early sign of rheumatic valvular disease ; but here there are general abnormalities apart from the local sign."

Careful study of this work should assist the inexperienced to improve the standards of his work. The book deserves high commendation.

J. B.

PSYCHOLOGICAL ASPECTS OF CLINICAL MEDICINE. By Stephen Barton Hall, M.D., D.P.M. London : H. K. Lewis & Co. Ltd. 1949. Pp. 416. Price 21s.

The writer of this book aims at the integration of clinical and psychological medicine rather than removing the latter from the total picture presented by the patient. He is to be congratulated on having achieved considerable success. Systematic and factual descriptions of reaction types are avoided and in the manner of the essay the author deals with the personal, social and medical problems presented by the patient and the correlation of disorder of function and disease of structure. He aligns himself with the outlook of scientific medicine rather than with the dynamic approach when this is prone to fanciful conception. There is little sacrifice of coherence in the form of presentation.

In the details given on methods of examination there is much of practical value for those lacking systematic training or experience. The same applies to the section on the psychological aspects of management where the prospects of success for different forms of therapy are set forth and much information on their introduction to the patient and his relatives given. The lengthy chapter on psychosomatic relationships of bodily disorders is productive of broader understanding for the clinician ; that on psychometry in its relation to medicine will perhaps be found more difficult to fit into the framework of the clinician's approach. A feature of the work is provided by excellent illustrative case histories and its value is enhanced by limited bibliographies at the end of each chapter. The medical officer in the Services will find many informative discussions dealing with everyday problems which confront him.

J. B.

DISEASES OF THE WARM CLIMATES. By Albert Dubois, M.D., and L. Van Den Berghe, M.D., D.Sc. London : William Heinemann (Medical Books) Ltd. 1948. Pp. 445. Price 42s.

Systems of doctrine and the methods of their practical application tend to show features moulded by the schools of thought of their countries of origin. Under the influence of international contacts and the work of the World Health Organisation many of these features are being rounded off, but the study of literature other than our own remains essential for the broadening of the mind.

There is a book representing the work of the Belgian Institute of Tropical Medicine and at the same time integrating therewith much doctrine carefully culled from other sources, world wide. Diseases the incidence of which does not differ perceptibly in the tropics and in temperate zones are not included. Cosmopolitan diseases which have shown an increasing rate of morbidity or mortality in tropical regions are dealt with briefly. Blood diseases, for example, including reference to sickling traits, are covered in two pages. The physiological and pathological effects of warm climates are dealt with in twelve pages and include an informative concise account of the effects of heat. Else-

where in the book some of the descriptions of disease features are sketchy—that of liver abscess might be cited—while the work on diagnostic procedures and treatment is detailed and adequate. There are approximately 100 illustrations including many excellent photographs.

The clarity of English version—the work is published concurrently in French—is occasionally hampered by choice of expression. It repays close study, however, and brings a wider vision to the reader versed only in the text book literature emanating from English-speaking sources.

J. B.

THE RED CROSS AND THE WHITE. By Hilary St. George Saunders. Published by Hollis & Carter. Quarto. Pp. 195. 23 illustrations. Price 8s. 6d.

To quote from Mr. Hilary Saunders' own words . . . "There can be few persons in England during the six years of the Second World War who did not at one time or another see something of the work of the War Organization. Red Cross and St. John workers were to be seen wherever bombs were falling, wherever wounded from the fighting fronts were being moved, and their canteens and tea cars appeared in the most unexpected corners. But the home services of the British Red Cross performed a large number of activities, known to those who benefited but seldom heard of by the ordinary citizen. They touched in some way almost every sphere of life where suffering was to be found.

This book covers the work of the Joint War Organization of the British Red Cross Society and the Order of St. John of Jerusalem during the 1939–45 War in all its aspects. The bulk of the book deals with the care and protection of Prisoners of War, the provision of the comforts for them, tracing of relatives and of missing prisoners. The book also deals with the organization at home for the production and distribution of "Comforts," the missing persons research bureau, the work of the ambulances, the nature and the work of the commissions overseas, the care of distressed, displaced civilians, in fact every activity which the Red Cross and the White Cross undertook in every theatre of war.

The book is attractively produced and it is very readable. It explains lucidly and humanly what the aim of the Joint War Organization was, how it tackled its self-imposed task, and opens the reader's eyes to the infinity of jobs that were done quietly behind the scenes by the Organization and its voluntary helpers.

S. M.

Extracts from the "London Gazette"

List A

(1) PROMOTIONS

(a) *R.A.M.C.*

- | | | |
|--|---------|----------------|
| (i) Lt.-Col. to be Col. : | | |
| J. N. Atkinson | 17.9.49 | |
| (ii) Maj. to be Lt.-Col. : | | |
| D. S. Cochran | 17.9.49 | |
| (iii) Caps. to be Majs. : | | |
| T. B. Harrison | 14.8.49 | |
| J. F. Webb | 28.8.49 | |
| (iv) Short Serv. Commn. Capt. to be Maj. : | | |
| I. A. Jackson | 2.11.48 | (sen. 13.6.48) |

(b) *R.A.D.C.*

- | | |
|----------------------------|---------|
| (i) Lt.-Col. to be Col. : | |
| B. Abbott | 11.9.49 |
| (ii) Maj. to be Lt.-Col. : | |
| R. H. Green, <i>M.B.E.</i> | 11.9.49 |

(2) RETIREMENTS

(a) *R.A.M.C.*

- | | | |
|---|---------|-----------------|
| Capt. O. G. Jones | 26.8.49 | |
| Capt. (WS. Maj.) I. F. Fraser, | | |
| <i>M.D., M.R.C.P. (S.S.C.)</i> | 29.8.49 | (Hon. Major) |
| Capt. J. E. G. Earle (S.S.C.) | 5.1.49 | (Hon. Lt.-Col.) |
| Capt. W. G. Canning, <i>M.B. (S.S.C.)</i> | 3.9.49 | (Hon. Major) |
| Capt. C. C. Petrovsky | 30.9.49 | (Hon. Major) |
| Lt.-Col. P. E. D. Pank | 6.9.49 | (Hon. Colonel) |

(b) *R.A.M.C.*

- | | |
|---------------------|---------|
| Colonel T. D. Corke | 11.9.49 |
|---------------------|---------|

(3) APPOINTMENTS TO REGULAR AND SHORT SERVICE COMMISSIONS

R.A.M.C.

- | | | |
|---|---------|-------------------------------|
| (i) From Short Serv. Commn. to be Maj. : | | |
| W. N. S. Donaldson | 21.6.49 | (retaining present seniority) |
| (ii) From Emerg. Commn. to be Capts : | | |
| Capt. J. D. Lumsden, <i>M.B.</i> | 17.8.49 | (retaining present seniority) |
| Capt. R. P. Goulden, <i>M.B.</i> | 16.9.49 | (retaining present seniority) |
| Maj. I. A. Jackson, <i>M.B.E., M.B.</i> | 2.11.48 | (sen. 13.6.41) |
| WS.Maj. L. R. Dalton | 24.1.46 | (retaining present sen.) |
| (iii) From National Service List to be Lt.: | | |
| D. K. Tucker | 19.8.49 | (retaining present sen.) |
| (iv) From Emerg. Commn. to be Capt. | | |
| (A. and T.) | | |
| Capt. (Q.M.) S. Chapman | 1.4.49 | (sen. 25.10.45) |

List B

(1) HONOURS AND AWARDS

R.A.M.C. (T.A.)

- (a) The King has been graciously pleased to confer "The Efficiency Decoration, and 1st Clasp" upon the following officer of the Territorial Army :
- Royal Army Medical Corps.
- Major F. V. Allen, *O.B.E.*

(b) The King has been graciously pleased to confer "The Efficiency Decoration" upon the following officers of the Territorial Army.

Royal Army Medical Corps.

Lt.-Col. H. D. Chalke, *O.B.E.*

Major A. D. Stoker.

(2) PROMOTIONS

(a) *R.A.M.C.*

(i) Maj. to be Lt.-Col. :

A. M. Pugh 29.10.49

(ii) Capt. to be Maj.:

O. S. Williams 13.9.49

(iii) S.S.C. to be Majs.:

A. J. Leslie-Spinks, *B.M.* 12.9.49 (sen. 21.11.47)

H. T. Chiswell, *O.B.E.* 10.9.49 (sen. 30.8.48)

(b) *R.A.D.C.*

Lt.-Col. to be Col.:

J. B. Cowie, *O.B.E.*, *M.M.*, *F.D.S.* 24.10.49

(3) RETIREMENTS

(a) *R.A.M.C.*

Capt. F. Zammit (S.S.C.) 21.8.49

Capt. R. H. F. James (S.S.C.) 7.10.49

Capt. J. M. Corall, *M.B.* (S.S.C.) 7.6.46 (Hon. Lt.-Col.)

Capt. J. P. X. Fox (S.S.C.) 18.1.47 (Hon. Major)

Capt. H. L. Simon, *M.B.* (S.S.C.)
(disability) 10.10.49

Major J. G. Peacock 18.10.49

Lt.-Col. C. G. G. Keane, *O.B.E.* 1.11.49 (Hon. Col.)

Capt. R. M. B. Talbot 28.10.49 (Hon. Major)

(b) *R.A.D.C.*

Colonel P. E. Brown. 24.10.49

(4) APPOINTMENTS TO REGULAR AND SHORT SERVICE COMMISSIONS

(a) *R.A.M.C.*

(i) From Short Serv. Commn. (Type "B") to be Capt. :

Lt.-Col. A. J. Leslie-Spinks, *B.M.* 12.9.49 (retaining present seniority)

(ii) From Short Serv. Commn. to be Capt.:

Capt. M. H. Barry-Walsh 21.6.49 (retaining present seniority)

(iii) From Emerg. Commn. to be Capt.:

Maj. (Hon. Col.) H. T. Chiswell,
O.B.E. 10.9.49

(iv) From National Serv. List to be Lt.:

Lt. W. O. Backus 4.10.49 (retaining present seniority)

(5) RE-EMPLOYMENT

R.A.M.C. (Retd.)

Lt.-Col. F. M. Lipscomb, *O.B.E.*, *F.R.C.P.*, re-employed to be Physician and Surgeon, Royal Hospital, Chelsea (with pay and allces. of Major) relinquishing the hon. rank of Colonel whilst so employed. 9.9.49

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Editorial

CERTAIN changes are taking place in the administration and management of the Journal.

As from January 1, 1950, the Management and Editorial staffs will work as part of the Royal Army Medical College. This, it is hoped, will bring about a closer liaison between the professional (teaching and research) activities of the Corps and our own professional Journal.

The manager will be the assistant Commandant of the College with his accountant and clerical staff. The Editor will have as his clerk and personal assistant the College Librarian. For advice and help in the collection and selection of articles the Editor will have an Editorial Committee made up of the Directors of Army Health, Medicine, Surgery, Pathology and Psychiatry, together with the Inspector of Training and an officer of the Territorial Army.

With the assistance of this committee—who are quite distinct from the committee of management of the Journal (The Library and Journal Committee)—it is hoped that a high professional standard may be reached and maintained.

This it may be stated, here and now, depends on the number as well as the quality of articles submitted for publication.

The present attitude of the Editorial Staff towards “make-up” day is tinged with no little fatalism and a pious hope that, with the grace of Allah, something will turn up.

It will not have escaped the notice of subscribers—and potential subscribers—that the Journal has a definite time-lag in appearing. This is due to a multiplicity of inter-acting factors which we have every reason to believe will cease to operate under the new system of management. We enter 1950 with the pious hope that the Journal will henceforth appear during the month appearing on its title page.

It is felt that the Journal should concentrate on our professional activities. The Magazine—which is supplied to all subscribers—covers social and general

activities. From time to time there may be activities which although not strictly professional are more suitably recorded in the Journal. Our pages are always open to articles of a general nature dealing with travel, sport, unusual adventures or misadventures befalling officers of the Corps and the like. We are even prepared to accept metaphysical speculations and philosophical animadversions upon the vicissitudes of life in the Corps should any of our more seriously minded officers see fit to have their views recorded for the benefit alike of their fellows and posterity.

Manuscripts—preferably typed, double spacing, on one side of the paper only, with at least an inch margin—may be sent direct to the Editor at The Royal Army Medical College, London, S.W.1, in the case of non-serving officers or, in the case of serving officers to The Editor, A.D.M. 7, The War Office, London, S.W., through the normal channels, for publication in the Journal of the R.A.M.C.

It has always been the policy to encourage young writers and articles from junior officers always receive our sympathetic consideration.

ERRATUM

Number for November, 1949, pages 256 *et seq.*

We wish to apologize to our readers and to the writer for the incorrect description of the *Salmonella typhi*. We made an inexplicable and inexcusable mistake which should not have occurred.

Original Communications

PRACTICAL NOTES ON SCRUB TYPHUS IN THE FIELD

BY

J. R. AUDY¹

*Hon. Lieutenant-Colonel Royal Army Medical Corps, formerly Officer in Charge,
Scrub Typhus Research Laboratory (Imphal), South-East Asia Command.*

INTRODUCTION

SCRUB TYPHUS (mite typhus, tsutsugamushi disease, or Japanese river fever²) is distributed in patches over the whole Oriental region, including islands in the Indian Ocean, and extending into Queensland, just beyond New Guinea, and northwards to include Japan.

The object of the present paper is to draw attention to practical points in the prevention of infection in the field. For those who require detailed knowledge of various aspects, a guide to the recent literature is appended.

Symptoms of scrub typhus appear one to three weeks, usually ten to twelve days, after being bitten by an infected mite (*Trombicula akamushi* or *T. deliensis*). A severe bout of fever follows, lasting two to three weeks and associated with a mortality which varies according to the virulence of the local strain, the condition and age of the victim, and the immediate nursing facilities.

When numbers of men enter endemic foci, cases of scrub typhus may occur in epidemic proportions and, unlike most sickness and battle casualties, estimates cannot be made in advance. At any moment serious local setbacks may be encountered during a campaign. Scrub typhus casualties may fill up the forward hospital beds at awkward times, a likely circumstance because outbreaks usually coincide with occupation of new territory, and because the immediate forward nursing of these cases is very important and greatly improves the prognosis.

Innumerable examples could be chosen to illustrate this. East African units of less than Brigade strength suddenly suffered no less than 756 cases in January 1944 after exposure to an infected focus in South Ceylon for only four days. Over 900 more cases contracted in the Imphal-Kabaw valley area from June to December raised the scrub typhus casualties of the 11th East African

¹Now at the Institute for Medical Research, Kuala Lumpur.

²*Tsutsuga-mushi* = dangerous bug or mite. The first studies were made in Japan where this disease is a very distinctive fever in certain notorious valleys. Apart from this, there is no association with Japan, and scrub typhus is more particularly an Indo-Malaysian disease.

Division to over 1,600 in twelve months, while one battalion which approached Kalewa on the Chindwin passed through an infected area and had an outbreak of 85 cases of scrub typhus coinciding with its arrival at the objective. The 5th Indian Division also suffered about 900 cases during the drive down the Tiddim Road, and in two months one unit's scrub typhus casualties amounted to 18 per cent of its strength, 5 per cent of the unit dying of this disease.

Morale was at one time considerably lowered by this disease, and men whose units had been in contact with scrub typhus were often more afraid of clumps of grass than they were of the enemy. This attitude will never be marked again, but the effect of scrub typhus on military calculations remains.

LOCALIZATION AND VARIATION

The patchiness in distribution of scrub typhus is on two scales, firstly into *endemic areas* which may extend over a few to several thousand square miles, the classical examples being the restricted infected regions of certain rivers in Japan; secondly, into "*typhus islands*" or individual infected foci, which may be restricted even to a few square yards. The Japanese call such infected foci *yudokuchi* or "noxious areas." If a large number of typhus-islands, or a proportion of very heavily infected typhus-islands, occur in an endemic region, it is usually called hyperendemic, but a single focus may give rise to an alarming proportion of cases even though it may be in a region of generally low endemicity. Casualties are consequently most difficult to predict.

The disease appears to be most sharply localized in scattered "islands" in the plains of India, the Dry Zone of Central Burma and in Japan, and possibly Central China, while it appears at present to be poorly established in north and west Ceylon, and to be restricted to only a small part of Queensland in Australia.

Both theory and observation suggest that scrub typhus should gradually become more widely established and that there is a natural limit towards which the number and extent of typhus-islands in an area tend to increase. It is certain (a) that infection can persist in the same spot for decades; (b) that the extent and endemicity of any focus may vary, perhaps considerably, from year to year; (c) that the disease may apparently appear *de novo* in a potential focus, and may also, but rarely, apparently disappear, and (d) that the actual virulence and even antigenic properties of the organism vary from place to place, and quite possibly in the same place from time to time.

THE ÆTIOLOGICAL AGENT, *Rickettsia Tsutsugamushi*

The infective agent, *Rickettsia tsutsugamushi* (= *R. orientalis*), usually appears as diplococcoid intracytoplasmic bodies somewhat smaller than a gonococcus. These occur occasionally but naturally as symbiotes in the tissue cells of certain trombiculid mites, and invade temporarily the blood and tissues of a number of animal and avian hosts on which the mites are regularly parasitic, causing mild symptoms or none at all. Such hosts, it is assumed,

may, by acting as temporary "reservoirs," serve to boost infection amongst the mites.

The organism pervades all the tissues of the mites (in common with the related rickettsiæ of tick-typhus) and once present is passed, to an unknown extent, through the gonads to the eggs and so to following generations. This congenital or trans-ovarial transmission of infection through parent mite to offspring has been experimentally confirmed in both the species of vector mite. The proportion of infected mites in any endemic area is not accurately known but evidence suggests that (a) this proportion is related to the intensity and duration of the mite-host-mite cycle in an infected focus, and (b) as with Rocky Mountain spotted fever infection in ticks, the usual rates are none or a few per thousand, but the proportion may rise to well over 10 per cent in hyperendemic foci.

THE VECTOR

The vector is for practical purposes best considered as a single variable species occurring in two extreme forms and several intermediates, its range of course coinciding with that of scrub typhus. The form *Trombicula akamushi* occurs in the east and north-east part of the range, while the form *T. deliensis*¹ is poorly represented in the north-east but extends from Queensland to India. In the region from Malaya to New Guinea and the Philippines, the two subspecies overlap, and either may be an effective vector in adjoining foci, or they may even occur together in the same focus. It is possible that another species might occasionally transmit infection in an endemic area but this must be quite exceptional and so of no practical importance.

The mites belong to the family Trombiculidæ, of which the six-legged larvæ are parasitic and are known as "chiggers" (an American name) and as "harvest mites" in Britain. Those which attack man have various local names. After feeding on an animal or bird, the larvæ go into the soil, pass through a pupa-like stage, and become eight-legged nymphs and finally adults, about 1 mm. long, which live in the soil and lay eggs there if conditions are suitable. The nymphs and adults of the vector prey on various soil denizens: they are not vegetarian, as was formerly supposed. The whole cycle probably takes eight to twelve or more weeks in nature.

The minute larval vector mites can readily be seen with the naked eye or a hand-lens, usually forming reddish orange clusters in the ears, on the thighs or near the genitals of all kinds of animals frequenting the scrub. Rats, squirrels, tree-shrews and such birds as crow-pheasants and quail are the commonest hosts, and presumably all these may act as temporary "reservoirs." Other chiggers are white or pale yellow or bright scarlet and sometimes rather large. Orange-red or orange-ochre coloured mites in any numbers on rats are usually of the vector species. An average of 25 per cent of rats lightly infested,

¹American authorities are proposing a subspecies, *T. akamushi deliensis*. Accepted synonyms for the vectors are: *T. walchi*=*T. vanderghinstei*=*T. deliensis* and *T. Fletcheri*=*T. obscura*=*T. akamushi*.

or of 25 vector mites per rat, appears to be roughly the lower danger limit. Larvæ may remain alive for at least one to two months without a feed.

Several species of chigger cause violent irritation some time after attendant, like the harvest-mite. This irritation, "scrub-itch," can be most disturbing. It is quite unrelated to scrub typhus. The following species proved troublesome to troops in Australia and New Guinea: *Trombicula minor* (= *Eutrombicula wichmanni*), *Schongastia pusilla* (= *S. schüffneri*), *S. blestowei* (= *S. vandersande*),¹ while other Australian scrub-itch mites are *T. samboni*, *T. sarcina* and *Acomatacarus australiensis*. The first two species have both been mooted as possible vectors in New Guinea and Sumatra, but they are absent from most infected foci and very abundant in many non-endemic areas.

SEASONAL INCIDENCE AND MOIST FOCI

The larvæ appear seasonally in a monsoon climate, the main peak being a month or two after the onset of the rains, while the larvæ are suppressed by prolonged dryness or extreme cold. This seems to be due to a hibernation of the adult mites in dry soil: larvæ persist in moist foci throughout the dry season (Audy, 1949c). These perennially moist foci such as seepages, stream sides and moist gullies must therefore be avoided. There is usually no distinct seasonal incidence in equatorial climates but the larval population will be found to drop during continued dry spells.

EFFECT ON MAN

Observations by McCulloch (1946), the U.S.A. Typhus Commission and the Scrub Typhus Research Laboratory, S.E.A.C., suggest that the maximum risk to man obtains in the following conditions:

(a) Sitting or lying, or standing about, on infested ground—not walking through it.

(b) Periods of slight rainfall, or no rainfall but heavy dew, following heavier rainy spells—not during waterlogged conditions or repeated heavy storms *nor* after long dry spells.

(c) The period while dew or rain is evaporating off the ground, until the heat of the day starts to become intense—say up to 10 or 11 a.m. The risk is greatly lessened throughout the day, especially on sunny days, to rise again with the rising humidity in the late evening. Activity continues through the night, especially if warm.

The bite of the mite is usually unnoticed (*see* Fuller, 1947) but (presumably when it attaches in close relation to a pain-corpuscle, or when it rapidly produces a horny sucking-tube in the tissues) it may produce a very distinct pricking sensation when touched. The scrub-itch mites, however, produce a delayed but intense reaction.

¹The names in parentheses are the correct equivalents as accepted by Womersley and the American authorities.

EFFECT OF CAMPING

The proper clearing and "civilization" of a camp produces conditions unfavourable to the mite, probably largely by drying out and compacting the soil, so that the risk of occupying an infected site drops rapidly after the first week or so. There is, however, risk from two sources, as was learnt in both Assam-Burma and New Guinea: (a) the persistence of mites in small isolated clumps of grass within the camp or in the periphery, and (b) in the event of encouragement of rats near such patches, or in the repeated abandonment and reoccupation of sites, a period of neglect intervening. Evidence was gained during the war that the endemicity was rapidly increased in camp sites following abandonment to weeds and rats.

OUTBREAKS

The incubation period ranges about twelve days, to which we must add a diagnostic interval, which is now happily shortened. Even so, the recognition of an outbreak often takes some three weeks after occupation of the infected site. By this time the risk is usually greatly reduced or eliminated and most of the cases are either febrile or incubating, so that nothing can readily be done to prevent the main outbreak. As the outbreaks cause the greatest disruption of services, our first effort should obviously be directed at shortening this interval between infection and the diagnosis of the first case or two, especially as chloromycetin is a drug which could successfully abort the remaining infections.

There are four requirements in avoiding outbreaks: avoidance of infected foci when possible; the proper and immediate clearing of the occupied site; the early rousing of suspicions after occupation; and the early diagnosis of cases and their notification to the units. We may take these points in turn; but as the practicability of all these measures varies very greatly with the circumstances, there is clearly no point in doing more than draw attention to a few features. It will be noted that there were 600 cases of scrub typhus in Burma in 1945 in spite of the fact that dibutylphthalate was widely distributed and fully advertised and was applied on official parades. The need for avoidance will always remain.

(a) *Avoidance*.—The conditions and situations in which most of the endemic foci occur are summarized below. If there is time and opportunity, the site should be "surveyed," for useful information can be gained even in one day, as described briefly below.

(b) *Clearing*.—Immediate proper clearing by fully protected personnel, preferably by bulldozer, is most important. Sometimes it is possible to wait for a long dry spell before clearing a site in an endemic area.

(c) *Early Suspicions*.—For the first few days, it is wise to look for mites which may crawl on to boots after standing for a few minutes and pairs of men may be detailed to do this for a short time before or after breakfast. This must be done in the cool of the morning while the ground surface

humidity is high. If the vector mites are found on boots, the area is almost certain to be dangerous, as this is not an efficient method except with considerable populations. The very patchy distribution of the mites must be borne in mind. Negative boot-catches are meaningless. All mites seen must be picked up with a moistened bristle or grass blade and identified.

It is sensible always to look for rat burrows, while in many types of undergrowth, rat-runs may be picked out by the keen observer. Faecal pellets may be found. All these give a very good pointer to the rat population.

(d) *Diagnosis and Notification.*—It frequently happens that the unit receives its first notification by signal or post after a diagnosis has been confirmed. In the earlier days of the war this was sometimes withheld until serological confirmation was obtained. The local organization should be such that clinical diagnoses are communicated immediately to both the unit and the responsible hygiene officers or R.M.O.s. For the hygiene officers, a graphic method of presenting the case incidence is essential, but the writer has noted that the data on spot-maps were frequently so held up by various causes as to lag a month behind the dates of actual infection of the first cases.

The units require early notification so that R.M.O.s and others can anticipate further casualties and take appropriate steps. It is most important that following units gain by the experiences of those preceding them. Rapidly advancing units of the 14th Army and Burma Command in several instances took over sites which had recently caused a crop of cases among the previous occupants.

The hygiene officers amongst other things require a general picture of the endemicity of the areas successively occupied by troops, the patchy distribution of the disease being borne in mind. The accurate pin-pointing of all infected foci is most important, and on active operations this might best be effected by coaching patients with NYD fevers, that is, by the R.M.O.s assuming the case to be one of scrub typhus, questioning the patient in an effort to pin-point the presumptive infection, and then instructing the patient clearly as to where infection was probably picked up—if it turns out to be scrub typhus and if he has asked about it. This would eliminate the extreme vagueness so common when questioning sick men.

METHODS OF SURVEY

The simplest methods of survey involve inspecting the mites on animals living on the site, and the following account is confined to these in the hopes that it may help hygiene officers and malariologists who may be called upon to make decisions in scrub typhus areas. The risk of infection at any time is related to the population of the vector species as estimated by the numbers found on rodents and short-ranged birds such as quail and crow-pheasants.

(a) *Collection.*—Attempt to trap (alive if possible) and shoot the largest number of rodents and birds from each patch of terrain concerned. Examine all killed hosts preferably within an hour or so, for many larvæ will leave

the dead hosts. Inspect the insides and edges of the ears and around the vent and genitals, the teats, thighs and under the wings for clusters of mites looking like tiny eggs. Animals may be carried for a time in tough paper or cloth bags which are afterwards searched. A magnifying electric auriscope is most useful for inspecting ears in the field. Mites are best collected (i) by scraping colonies out of ears with a Volkmann's spoon or similar instrument, and floating in water overnight so that the mites may struggle free from the debris, or (ii) by excising ears and pieces of infested skin, pinning these to the corks of specimen tubes, leaving overnight for the mites to detach and adding some 70 per cent spirit the next day, or (iii) by suspending the dead animals by the tail over dishes of water, when the mites will shortly be found floating.

(b) *Identification of the hosts is not essential* but should always be done if possible. The following records should be made even if skull and skin are not preserved: measurements of nose-tip to tail-tip, tail, ear and hind-foot excluding claws, colours and general description, locality and habitat. Skulls are best dried with the flesh on and preserved from insects.

(c) *Identification of the mites* may be done provisionally in lactophenol using a 4 mm. objective. Although the identification of trombiculids is a job for an expert, the vector in endemic foci is nearly always a dominant and frequent species on rats, and confusion with similar uncommon species is thus less probable. Identification is based on the characters of the larval dorsal shield or *scutum*, the edges of which may be faintly discerned immediately behind the mouth-parts and between the two red eyes. Behind the scutum are rows of dorsal setæ. The most conspicuous feature of the scutum is the pair of chitinous rings or pores from which arise sensory organs (*sensillæ*) which may be clubbed, globular or filamentous: these often become detached, especially if clubbed. There are typically 4 "corner" setæ (antero- and postero-laterals) and 0, 1 or 2 antero-median setæ, while sometimes dorsal setæ are included in a backward extension of the scutum (*see* fig. 1).

The generic groups may be distinguished thus:

- | | | | | | | | | |
|---|-----|-----|-----|-----|-----|-----|-----|---|
| (1) No anteromedian seta: sensillæ swollen; scutum often convex behind and encroaching on the dorsal setæ; widespread in small numbers, commonest in forest | ... | ... | ... | ... | ... | ... | ... | <i>Gahrlepiea</i>
(<i>Walchia</i>)
group. |
| One anteromedian seta (making 5 scutal setæ and 2 sensillæ); widespread and common | ... | ... | ... | ... | ... | ... | 2 | |
| Two anteromedian setæ; rare on rodents | ... | ... | ... | ... | ... | ... | ... | <i>Leeuwenhoekiid</i>
group. |
| (2) Sensillæ globose or clubbed | ... | ... | ... | ... | ... | ... | ... | <i>Schöngastia</i>
group. |
| Sensillæ filamentous | ... | ... | ... | ... | ... | ... | ... | <i>Trombicula</i>
group. |

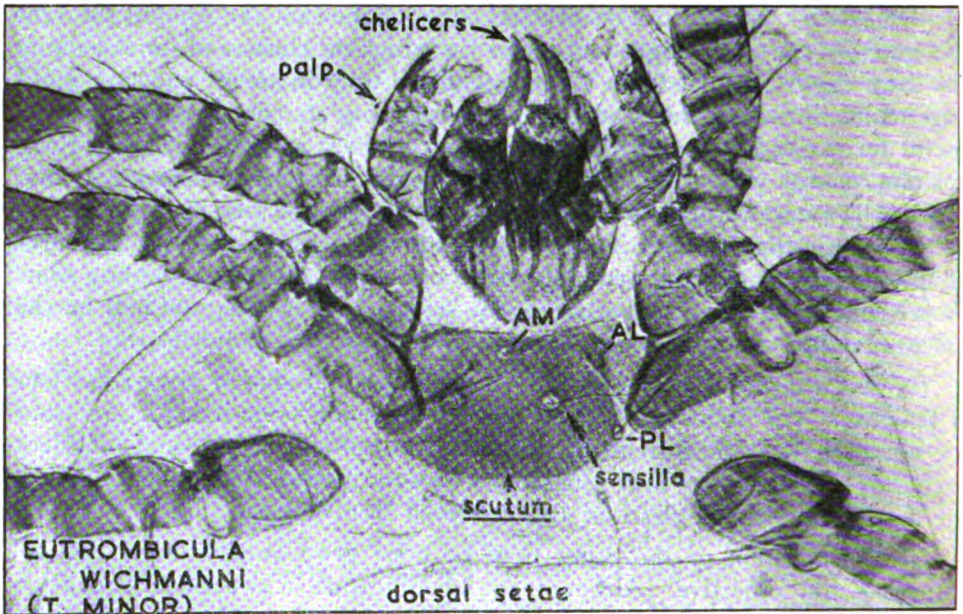


FIG. 1.—*Eutrombicula wichmanni* (Oudemans), larva. (Synonyms: *Trombicula minor* Berlese; *T. hirsti* Sambon; *T. pseudoakamushi* Hatori). From a rat, near Kuala Lumpur. A scrub-itch mite common in Queensland and New Guinea but also found from Assam-Burma to Sumatra and Formosa. The major hosts are birds. Not known to be a vector.

Vectors.—The larval vectors are orange or reddish-orange, becoming paler with engorgement; not bright red, scarlet, vermilion or white. The site of election is within the conchæ of rats' ears. The scutum is rectangular, with the sensory bases $22\text{--}38\ \mu$ apart and slightly anterior to the posterolateral setæ ("PLs"). In *deliensis* the hind edge of the scutum is some $12\ \mu$ behind the line of the PLs and the dorsal setæ number 28 fairly regularly, in rows 2. 8. 6. 6. 4. 2. In *akamushi* the hind margin is only half this depth behind the PLs and the dorsal setæ number 30–40 in rows of 2. 10 (or 8). 8. 8. 6. 4. 2. Compare specimens with the photograph, fig. 2. Measurements covering the known extremes are omitted as they embrace several other lesser known species. Confirmation of identities may be obtained from the British Museum (Natural History), Mr. H. Womersley, South Australian Museum, Adelaide, or the Scrub Typhus Research Unit, Institute for Medical Research, Kuala Lumpur, Malaya.¹

(d) **Interpretation.**—Heavy infestation by any species of trombiculid mite should raise suspicions. Infestation by *T. deliensis* may be roughly interpreted as follows, always making allowance for such events as a recent spell of dry weather:

¹The Scrub Typhus Research Unit is prepared to send named slides of *T. deliensis*, *T. akamushi* and *Euschöngastia* (= *Ascoschöngastia*) *indica* to those requiring specimens for teaching purposes or to those who intend to collect trombiculids.



FIG. 2.—*Trombicula akamushi* (Brumpt), a larva from the ear of the vole *Microtus montebelloi* from Niigata district, Japan. Collected by Colonel C. B. Philip and presented to the writer. The scutum is characteristic of *T. akamushi* but the dorsal setæ (of which one set has been picked out in black) are 2.8.6.8.4.2, i.e. intermediate between the numbers typical of *T. akamushi* and *T. deliensis*. These setæ must be counted carefully and may be confused with those on the venter. Intermediate forms are not common.

(i) 1 in 10 rats¹ infested, or an average of over 5 mites per rat: further investigation advisable, to make sure a restricted focus is not being missed.

(ii) 3–4 in 10 rats infested, or over 15 mites per rat: some risk of scrub typhus likely in an endemic neighbourhood.

¹Mice and the small rat, *Rattus exulans* (= *R. concolor*) are often relatively lightly infested and, except perhaps in the Pacific theatre, negative findings on these should be ignored. The best index is to be gained from the locally prevalent sub-species of *Rattus rattus*. A most useful description of, and keys to, the commensal rats are contained in a paper by Harrison (1949).

(iii) 6 or more rats in 10 infested or over 50 mites per rat: may be a hyperendemic focus—avoidance, full investigation or full precautions to be advised.

(iv) A single rat heavily infested (100 or more) immediately makes the risk positive.

Another rule-of-thumb guide, involving no identification of mites, is that during the typhus season (July to October inclusive in Burma and Assam) the infestation range which included most endemic foci of practical importance was the presence of 20 per cent or more of rats with orange-coloured colonies of mites in either ear, one-tenth of an inch or more in diameter.

Some hosts, such as birds in the scrub, may be relatively much more heavily infested than the rats in the same site. The rats are basically responsible for the ground-infestation, but a bird or other creature may pick up large numbers of larvæ by ranging more widely.

“TYPHUS SCRUB”

Scrub typhus is not strictly related to any species of plant or to any special vegetation, but it is related to terrain. Ecological studies made during the War suggest that, in spite of the difficulty and even risk of giving rule-of-thumb descriptions, the following may be taken as a useful practical guide to the particular types of terrain which are most dangerous.

Apart from its fringes, or natural or artificial interruptions, evidence suggests that virgin forest, and probably the depths of secondary forest with a leaf-litter floor, are generally free from risk of infection. So also are regular clean-cultivated areas.

(a) *Man-made waste land*, of three types:

(i) *Rural*—abandoned clearings, usually covered in grass and other weeds, especially if restricted and often especially round the edges. More or less shrub or tree growth may be present, but the grassy and weedy floor is the proper index.

(ii) *Domestic or “suburban” waste land*—neglected patches in or on the outskirts of villages and even towns, examples being the ground of Fort William in Calcutta and Fort Dufferin in Mandalay, and subsoil drainage bays in Kuala Lumpur. Included in this group are of course abandoned villages, camps and homesteads, as well as squatters’ areas.

(iii) *Neglected native gardens or plantations*—including weedy clearings in the latter.

(b) *Water-meadows*—grassy, but not swampy, river and stream banks (especially in monsoon climates).

(c) *The “Hedgerow” type of feature*, by which is implied firstly the region where grass or open scrub is flanked by woodland, and secondly, a range of features from a simple bushy hedgerow to the narrow gallery or belt of forest which, in deforested areas and frequently in and below foothills, is commonly left following water courses or ravines.

Sometimes this type of feature is broken up into bushy or wooded clumps, such as may sometimes be found in old sugar-cane fields, on cleared hillsides or amongst paddy.

PREVENTION BY PERSONAL PROTECTION

In concert with antimalarial measures, the entomological control of scrub typhus is directed firstly towards personal protection by the treatment of clothing with mite-poisons (*see* McCulloch, 1946), and secondly against the mites themselves on the surface of the ground. The acaricides available are as follows: they are mite-poisons and *not* mite-repellents:

DMP (di-methyl-phthalate), present in "Skat" and most other bottled "insect repellent." A rapid poison lasting only one or two washes, slightly oily and almost odourless.

DBP (di-butyl-phthalate) is heavier, slightly more oily and less rapid in action but lasts some six or seven washes and is therefore most practicable. Both these phthalates are in great demand by the plastic and other industries.

BB (benzyl benzoate) has a distinct smell, is rapid in action and lasts as long as DBP. DBP and BB in equal parts make a most useful mixture.

The dosage in all cases is the same.

All these agents are irritant to the eyes and tender parts, but this is least noticeable with DBP. BB is particularly irritant to certain individuals. A popular insect repellent contains DMP, Rutger's 612 and indalone ("6-2-2"). The presence of DMP is usually stated on the label. Powdered sulphur could be used if necessary. Benzil and other agents are extremely effective (Snyder and Morton, 1946).

Application.—The standard dosage is a teaspoonful to a pair of socks, or an ounce to a set of socks, trousers and shirt. This gives 90 per cent or more protection against scrub typhus or scrub-itch. DMP should be reapplied after laundering, but DBP lasts three boilings or six warm-water washes by hand.

A few drops in the hand, rubbed once to spread between the palms, is applied directly to the *inside* of the garment. Four such smears suffice for each side of each leg of the trousers with 2 extra for turnups and 10 smears for the rest of the garment. The Technical Memorandum on Scrub Typhus (9.12.46) of the Director of Medical Services, S.E.A.L.F., gives the following numbers of smears: socks, vests, cotton underpants and puttees, 6 smears each; trousers 30, blouse 25 (5 to each arm), making a total of 91 smears using 2 oz. of fluid. For personal use, McCulloch suggests applying DBP immediately before laundering to avoid the unpleasant collection of dust by the agent, and for home use recommends a shaker containing one part phthalate to two or three of water.

Dipping in 5 per cent emulsion is most useful. Use 8 oz. of DBP or BB per gallon of water containing 3½ oz. soap; dip the clothes, wring out lightly and dry. A U.S. Army mixture consists of BB, DMP and a soluble emulsifier in the proportions 9:9:2, diluted with 17 parts of water before use.

Native labourers may be encouraged to wear half-hose or sock or stocking tops, well impregnated with DBP and DMP, like sleeves on their calves and arms. A blanket impregnated with 6–10 oz. of DBP—BB mixture, or with gammexane at the rate of about 3 grammes of the *gamma* isomer per square foot (*vide* Horton *et al.*, 1948) will be most useful in some circumstances and would probably be effective for several months.

VACCINES AND CHEMOPROPHYLAXIS

The vaccine from lungs of cotton-rats prepared as a wartime emergency—"Operation Tyburn" (Buckland *et al.*, 1945)—went out of production in 1945. This vaccine was a success in the laboratory but circumstances prevented its evaluation in the protection of man and it is too costly to produce commercially. Experimental vaccines are being tried out from time to time. One may hope for little more than a great reduction of mortality and a mitigation of the clinical course.

Trials of chloromycetin (Smadel *et al.*, 1948, and this Journal, 1949) have shown that this drug is a promising chemoprophylactic and details of its use have been released.

PREVENTION BY FIELD CONTROL

(a) *Clearing*.—Clean clearing the ground, especially if this includes scraping off the top inch or so of soil, leads to a great reduction or even elimination of the mites. Adult mites, and presumably whatever larvæ are present, are little affected by firing undergrowth, but this is a useful prelude to ploughing or clearing as it encourages drying. The actual clearing is a very risky occupation and is best done by bulldozers. The choice of dry season, dry spells, and the latter part of the day for clearing reduces the risk. Particularly for temporary sites hurriedly prepared, clearing should be combined with chemical treatment when this is feasible. In more permanent camps, attention should be paid to neighbouring scrub, and it is suggested that putting the land under cultivation is an economical measure.

(b) *Chemical Methods*.—Petroleum and gammexane are the only two agents at present known to be of practical value. Petroleum, crude engine oil or diesel oil applied at the rate of 40 gallons per acre of soil effectively controls larvæ for a few days, which allows time for clearing the site. Applications may be repeated, using a knapsack or similar sprayer, the nozzle being kept below undergrowth with flat leaves or fronds. Petroleum was first used in Japan (Kawamura, 1926) but its value was properly established by tests made by Bushland (1946).

Gammexane is best applied in fuel oil or mixed with an inert dust, and is undoubtedly effective, while other agents are being tested by American workers. Linduska and Morton (1947) recommend dosages of 4–6 lb. per acre of crude benzene hexachloride (12 per cent *gamma*—i.e. $\frac{1}{2}$ – $\frac{3}{4}$ lb. *gamma* isomer per acre), mixed with three times its weight of talc or as 3 per cent in fuel oil. This gave a 95 per cent reduction in an hour or so lasting for three

to four weeks. McCulloch (1947) found the following to be effective for a fortnight against a tenacious scrub-itch mite in Australia: 1-1½ oz. per 6 square yards of 14 per cent of BHC in dust, equivalent to 1-1½ lb. of *gamma* per acre. Dosages of 1 lb. *gamma* per acre should be fully effective against the vectors if applied in fuel oil.

(c) *Anti-rat Measures.*—*Persistent anti-rat hygiene* is of great value in discouraging the establishment of scrub-typhus on a long-term basis, and its importance in the long run cannot be overestimated.

Active anti-rat measures in order to reduce an actual risk must, however, be undertaken only after careful consideration as they may prove quite uneconomical.

At any moment, the population of larval vector mites comprises two fractions, those free-living on the ground, and those feeding on various hosts such as rats. If the feeding of the latter fraction is interrupted by the death of the rats, a number of the attached mites may still be capable either of reattaching to another host or completing the life-cycle, while the remainder will die from various causes.

Laboratory observations suggest that as many as a third or a half of attached larvæ might, on the death of their hosts, either reattach owing to insufficient feeding, or having had more than a threshold feed may become viable nymphs. Moreover, these larvæ which are likely to remain viable appear to leave the host soonest after death, within a few hours. It is therefore economical to trap rats alive and destroy them properly so that their parasites do not escape. When dead rats are collected in endemic foci, the soil under and immediately around them should have gammexane stirred into the surface with a stick.

A second point is that a reduction of the rat population cannot reduce the generation of larvæ due to appear.

A third point to consider is that rats exercise an important function in "mopping up" free larvæ, so that anti-rat measures adopted too early will actually increase the risk of scrub typhus because a larger number of larvæ will remain free to attach to any alternative hosts which happen to contact them. On the other hand, if adopted too late, a large number of larvæ will have fed and returned to the soil, later to give rise to a second generation of larvæ.

It thus appears that in monsoon climates such as that of Burma, anti-rat measures must definitely not be adopted *in anticipation* of the "typhus season." Prebaiting should be begun at such a time that the greatest number of rats will be killed during and at the height of the first infestation peak, a month or so after the rains start. For the same reasons, such measures should not be adopted immediately before or during clearing operations. The best time is probably immediately after clearing, when skilful prebaiting might also attract the maximum number of rats.

In equatorial climates where seasonal changes are not marked, anti-rat

measures may probably best be adopted a month or so after the peak in pregnancy-rate amongst the rats, if this exists and is known. It is not possible yet to decide whether measures taken and continued some six months before clearing operations start will reduce the risk to labour or not, but this is worth trying provided the interval is not shortened.

If men are to be exposed after anti-rat measures, some attention should be given to the sites used for prebaiting. The pattern of ground-infestation by mites is related to the pattern of behaviour of the rats, and if the latter is radically altered, as it might be by the deviation of many rats to bait on new site, a large number of larvæ in established habitats might not be picked up, and this might increase the scrub typhus risk. As far as possible prebaiting sites should coincide with feeding sites normally preferred by the rats.

(d) *Attacking "Centres of Dispersal"*—All endemic foci must be regarded as potential centres of dispersal of infection. Typhus-islands such as those common in and around villages, towns and estates may thus be of practical importance as "reservoirs" of infected mites. Hedgerows and narrow forest belts, seepages and moist water meadows may serve as sanctuaries for rodents disturbed by scrub-fires or shifting cultivation, and consequently as hyper-endemic foci ignored by the local population. This is of practical importance, for it is not sensible to attempt to control a troublesome focus if an adjacent endemic "reservoir" is left uncontrolled. For example, in the case of the Oil Palm Estate near Kuala Lumpur described by Lewthwaite (1930) it is probably an essential part of control to attack the forest fringe at the perimeter, although no labourers may get infected there.

Both survey and control should therefore extend beyond the actual site of exposure about which there is direct concern.

SUMMARY

(1) Points likely to be of practical value to hygiene officers and epidemiologists are collected together and supported by a guide to the more detailed and comprehensive literature on scrub typhus.

(2) Some of the epidemiological points stressed are the localization of infection to endemic districts containing sharply restricted foci; the presence of a single vector species with two chief forms or sub-species, and the probable unimportance of other species of mite, and particularly of "*Trombicula minor*," a scrub-itch chigger; the reduction of questing larvæ (and consequently of the risk of infection) with lowered humidity associated with the time of day, with dry weather, or with operations such as clearing the undergrowth; the importance of avoiding outbreaks by taking steps before the first few cases appear, by which time it is usually too late to prevent the main bulk of casualties.

(3) Simple methods of survey are noted, comparable in method and object with malaria surveys. Notes are made on the prevention of infection by avoidance, individual protection by chemical treatment of clothing, and field

control. The value of gammexane on blankets and on the ground is stressed. Vaccines, other than experimental, are not available and there are many obstacles in the way of their production—one being the variation which exists between rickettsial strains. Chloromycetin is known to be an effective chemoprophylactic.

A GUIDE TO THE RECENT NON-CLINICAL LITERATURE ON SCRUB TYPHUS

The following papers are selected because they contain fairly complete accounts and, often, comprehensive bibliographies, while the subject matter is not purely technical and is likely to be of reference value to the workers for whom the present paper was written. Descriptions are added where the title is not fully explanatory.

(1) COMPREHENSIVE WORKS ON RICKETTSIALE AND RICKETTSIAL DISEASES

- MOULTON, F. R. (1948) (Editor) *Rickettsial Diseases of Man*, Washington. (27 papers; 3 confined to scrub typhus; others on vectors, reservoirs, relationships, nomenclature, treatment and serology.)
- RIVERS, T. M. (1948) (Editor) *Viral and Rickettsial Diseases of Man*, Lippincott. (8 papers on typhus fevers; 8 papers on rickettsial subjects; 1 on scrub typhus by Smadel.)
- STEINHAUS, E. A. (1946) *Insect Microbiology*, Comstock, N.Y. (Very comprehensive monograph includes descriptions of rickettsiae.)

(2) REVIEWS OF LITERATURE ON SCRUB TYPHUS

- BLAKE, F. G., MAXCY, K. F., SADUSK, J. F., KOHLS, G. M., and BELL, E. J. (1945) Studies on tsutsugamushi disease in New Guinea and adjacent islands: Epidemiology, clinical observations, and etiology in the Dobodura area, *Amer. J. Hyg.*, **41** (3), 243-373. (Contains comprehensive review of literature with 152 references.)
- FARNER, D. S., and KATSAMPES, C. P. (1944) Tsutsugamushi disease, *Nav. Med. Bull., Wash.*, **43**, 800-836. (Compact review with 201 references.)

(3) EPIDEMIOLOGY

(a) Reviews and General Descriptive Accounts

- AUDY, J. R. (1949a) A summary topographical account of scrub typhus, 1908-1946, *Bull. Inst. Med. Res., Malaya*, No. 1 of 1949. (Review of incidence and epidemiological features, with details of Indo-Burma region; 26 figs., maps and photographs.)
- PHILIP, C. B. (1948) Tsutsugamushi disease (scrub typhus) in World War II, *J. Parasitol.*, **34** (3), 169-91. (A valuable review of war experience; especially Pacific theatre; distribution map.)
- SAYERS, M. H. P., and HILL, I. G. W. (1948) The occurrence and identification of the typhus group of fevers in South East Asia, *J. Roy Army Med. Corps*, **90** (1), 6-22. (Reviews experiences in S.E.A.C. theatre; map and histograms of incidence.)

(b) Epidemiological Investigations in Indo-Burma Theatre

- AUDY, J. R. (1949a) *Loc. cit.* (General epidemiology and topography.)
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Asia. A report on investigations by the G.H.Q. (India) Field Typhus Research Team, and the Medical Research Council Field Typhus Team, based on the Scrub Typhus Research Laboratory, South East Asia Command, Imphal. [Audy, J. R., *et al.*] Restricted distribution; abstracted in *Trop. Dis. Bull.*, 1948, **45** (1), 62-70. (Includes reviews, 22 papers, 135 illustrations, on investigations in Manipur and Burma.)

(c) *Studies on Trombiculid Mites (Excluding Purely Systematic Papers)*

- AUDY, J. R. (1949c) The biology of trombiculid mites collected in Assam and Burma, *J. anim. Ecol.* (In press) (and in War Office report, 1947, Part III).
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THE TRAINING OF FIELD MEDICAL UNITS

BY

Colonel F. M. RICHARDSON, *D.S.O., O.B.E., M.D.*

Late Royal Army Medical Corps

(Continued from page 251)

IV.—FIELD CRAFT AND VISUAL TRAINING

The term "Fieldcraft" needs no explanation but perhaps "Visual Training" does. It is the term now used instead of the wartime one of "Concealment and Camouflage," and when it was introduced it was explained that "Visual Training supersedes and widens the scope of Camouflage, and embraces observation, including seeing at night, and Concealment." These subjects above all others should not be taught by drill.

The application of camouflage was included in our drill for laying out an A.D.S., but the devices to be used were never standardized. The Standing Orders of a unit may lay down the duty of camouflaging medical posts, but the methods of doing so must be left to the intelligence and ingenuity of men well grounded in the principles of the art. Men must be taught to think always in terms of the air observer's view as well as of ground observation—of the vertical more than of the horizontal view; and they must understand the importance of shadow and the influence upon it of texture. A simple demonstration will convince them of the fact that the blackest of shadows is that from the open back of a lorry or ambulance, which can be seen as a black spot from a great distance, though not from so far away as can the sun glinting on windscreens. They must learn to park their vehicles and to drape them with suitably garnished camouflage nets in a way which takes these points into consideration.

Fieldcraft and Visual Training are adequately dealt with in excellent training manuals, and the help of expert instructors is usually available.

Intelligent camouflage should be practised on all schemes, and men's knowledge of the principles tested by questions, but without the use of an aeroplane or air photographs it is seldom possible to drive home the lessons by actual observation. A well-constructed model ground viewed from a high wall is worth using if no other method is available, but it usually fails to bring out some of the points sufficiently clearly. Opportunities for exercises devoted purely to camouflage and to study of the "vertical view" are rare, and it is perhaps worth describing one such exercise in the Lebanon.

After driving up into the foothills the majority of the unit did a stiff climb of nearly three thousand feet to a place from which we could approach a viewpoint immediately above a little plateau about one thousand feet below. On this plateau was a small stone-built village to which the drivers, having dropped

the climbing party, had driven and dispersed and camouflaged their vehicles. Some of the vehicles were disguised as outhouses or groups of buildings, others as dunghills or as prolongations of stone walls. The climbers were brought to the viewpoint and given thirty-five to forty seconds to spot what they could, which is longer than an observer in a bombing 'plane would get. They then withdrew and had to describe what they had seen. Even I, who had made the camouflage plan, could not see more than one of the larger vehicles in the time allowed, and I saw none of the smaller ones. Next a longer look and the use of binoculars were allowed, and the camouflage plan was explained. Still some of them could hardly believe that all the vehicles were there, so well had the M.T.O. done his work. Then a Verey light was fired, camouflage nets and garnish were whipped off, and the vehicles stood revealed, the red crosses on the ambulances contributing to the startling contrast with the previous picture of a hill village which had never known a motor-car. It was a good climax to an exercise in which climbing practice and confidence in difficult ascents, hard physical exercise, and intelligent application of the principles of concealment and camouflage had been combined with the enjoyment of some of the finest scenery in the Middle East.

In explaining to other ranks the importance of this type of training one can stress the need in wartime for civilized man to regain by deliberate study some of the instinctive knowledge of his primitive ancestors. Birds and animals are provided by nature with protective colouring and instinctively make the best use of it, but modern man must learn how to merge himself into his surroundings and how to conceal evidence of his presence. Visual Training Pamphlet No. 1 says: "A knowledge of ground is not instinctive with most men and is developed only with interest." Men usually take an interest in fieldcraft, but it is well to be prepared to answer two possible questions on the need for visual training. One may be asked what place camouflage has in dressing stations where the Geneva Cross is profusely displayed on flags and large ground signs. R.A.P.s and C.C.P.s must of course always take their chance of air attack and shelling, and, although one may site the A.D.S. where it can hope from some immunity from deliberate air attack, there are often occasions when for tactical reasons to avoid betraying the commander's intentions the Geneva Cross is not displayed until after battle is joined. A knowledge of camouflage is then as important to us as it is to anyone, and so it may be also when conditions of failing light or poor visibility from other causes make us liable to attack by an enemy who would normally respect the Geneva Cross.

The second type of question is whether the development of air photography, especially with infra-red cameras, does not make camouflage futile. The answer to this is that even if all our ingenuity cannot defeat the interpreter of a good air photograph, his report must be translated into action by the bombing 'plane observer and bomb aimer, whose eyes are fallible and not gifted with infra-red vision. As they approach their pin-pointed target on the initial run and then on the bombing run, during which they are over our position for only a few seconds,

they can be put off their mark by clever camouflage. The more forward medical posts must, of course, contend not only with the bomber but with artillery fire, which, once the position has been pin-pointed by air observation and photography, is not deflected by camouflage. Nevertheless the teaching of a subject which is so obviously directed to self-preservation, and to the protection of our patients needs little justification.

V.—MAP READING AND NAVIGATION

The importance of constant instruction and practice in map reading and of teaching men to be conversant not only with British types of map but with those in use in the various theatres of war is sufficiently well recognized, and it is unnecessary to say much about the methods of instruction in map reading as these are adequately dealt with in the official publications.

Officers and N.C.O.s, at least, should also be taught about interpretation of air photographs which can be of great use in the planning phase of set-piece battles. Towards the end of the last war when everything was going according to plan we came to rely to a great extent upon well-signed roads and tracks, axis and centre line markings and so on, but it was never wise to go out without the map. Close study of the map is always essential before and during any engagement, and accurate map reading may on many occasions be important even to the most junior soldiers. For example if the selected route of evacuation is denied to us by enemy action, by cratering, etc., it may be the duty of any N.C.O. or man resolutely and energetically to search for an alternative route. Often this can only be done successfully and safely with the aid of a map. In many units one finds that private soldiers do not progress beyond the simple early stages of map reading, and often even N.C.O.s are not expected to understand the principles of resection. As an excuse for failure to give men more advanced teaching I have heard it said that the number of compasses available in a Field Ambulance is so limited that even N.C.O.s will not be called upon to practise resection, and therefore need not be made to study it. This argument has less weight than the fact that a knowledge of resection, and practice in observing bearings and plotting them on the map is a great help towards a better understanding of the map, and also in teaching men what is even more important to think in terms of points of the compass and so to become good pathfinders or navigators. Few of us—even Scotsmen who traditionally like to claim that they have a compass in their head or that they know their “airs”—have the good fortune to possess this gift, and not many are naturally good map readers. But having begun the war myself as a very poor map reader and having greatly improved myself by practice, only to relapse when I no longer needed to live by the map, I know from my own experience and from the results achieved in my units that by constant practice these assets can be acquired by nearly all men. With some six to eight prismatic compasses, protractors, and binoculars the whole unit can in a reasonably short time with patience and regular practice be taught the principles of resection, which can be reduced to

simplicity and given practical application by the construction and exhibition at each successive camp of a diagram showing how these principles can be applied to the local countryside. An example of such a diagram used during a brief rest period in the Normandy bridgehead is reproduced. The diagram should be put on a separate notice board at a suitable view point and section N.C.O.s should study it, explain it to their men, and ask them questions based upon it. In this or in some other way officers and N.C.O.s should, especially during operations, put all ranks "on the map" soon after arrival at each new location. They should point out useful features which can assist them in direction finding, and the stars or constellations by which they can find their way home at night. This is especially important in desert or feature-less country. Each new camp provides some new feature for study, and some way of catching out the unwary. All soldiers should know, as boy scouts and sailors do, how to "box the compass," and how to find North from the sun, and frequent practice should be given in this. They should be encouraged automatically to note from time to time the direction of North from the sun by day, and from the pole star by night. A good way of getting the points of the compass firmly fixed in their minds is to put a post with an arrow indicating Magnetic North outside the orderly room, guard tent, or office, in every camp occupied by the unit. This post can be placed in position by the R.S.M., or by a competent N.C.O. detailed by him, immediately after arrival at a new location. Some form of improvised sundial may be erected with the same purpose. On all schemes, cross country marches, and road moves maps must be taken and used. Men should be taught to think constantly in terms of points of the compass, distance, and direction, and to cultivate their powers of observation. At all halts men should be made to indicate points of the compass and to take bearings on landmarks and so fix the position, or if that is known to identify the landmarks with certainty. If one can find difficult objects the identification of which depends upon the use of the compass so much the better.

During operations when visiting the Brigade area I often took in my car one or two N.C.O.s to act as my navigator and be prepared at any time to tell me where we were and to identify objects from the map. Sometimes I deliberately chose difficult routes in an attempt to confuse them, and as some of them became expert map readers and could ask me awkward questions this helped to keep me alert myself. When men have to drive some distance in vehicles it is a good plan to divide the route into several stages by map references, and to make different men navigate the vehicles on each stage. Those sitting in the back should also have maps and should study them, to check on the navigator and to be prepared for their own turn. There are of course many other methods such as map reading paper chases or treasure hunts, etc., by which one can keep interest in the subject alive and can work up from simple to more difficult problems. Infinite variation can be introduced into map reading paper chases and road navigation schemes, and they can

be made additionally interesting and can provide a break in monotony if they include visits to interesting places of which guide book descriptions can be posted beside the Training Programme. They may end near a town to which men can go for recreation after the exercise is over. For route marches one should avoid roads and choose difficult country in which, after deliberately losing the way, parties of men can be handed over to N.C.O.s who have to return to camp by different routes. Men under consideration for promotion or as potential officers should be left at various points in hilly or difficult country to find their way home by a specified route, and to make thumbnail sketches at various points, and write a report after arrival. I remember one self-satisfied young private soldier who was only persuaded of his unsuitability as a candidate for a commission after he had spent a night in the Palestine hills and reached home nearly twelve hours overdue. It is useful to make everyone write a brief reconnaissance report after a route march, and if these are sometimes asked for unexpectedly it may prove to some men how little they have actually observed. Too often map reading and navigation tend to be regarded by the private soldier as an esoteric cult only to be practised by officers and N.C.O.s. Map reading should rather be for every man an integral part of all outdoor training, and the attitude towards it should be that of a sentence from Middle East Pamphlet No. 9 on Field Navigation: "To get 'lost' is not a misfortune but a delinquency."

Frequent practice in estimation of Distance is useful, and may be given in a variety of ways from posting men and vehicles at intervals up to about a thousand yards, to judging greater distances measured on a map, when the influence of dead ground on judging distance can be studied and explained. This subject and also the description and identification of objects on the ground by the Clock method belong properly under the heading of Visual Training, but it is often convenient to practise them during map reading instruction. The Clock method of describing objects is more important to other arms for the identification of targets, etc., but it may help R.A.M.C. men in developing their powers of observation.

However expert men may become in judging distance their estimates of the distance which they have travelled in a vehicle, especially at night, must never be accepted, and it is a point of great importance that on all journeys in vehicles drivers, drivers' mates, or navigators must observe and take notes of the milometer readings and of the exact distances between important places. This is especially necessary in desert navigation when one may have to rely in featureless country on driving for a certain number of miles on one bearing before changing to another on a course predetermined and plotted on the map. In such circumstances, and indeed always on active operations, it is wise to make the routine observation and recording of milometer readings a specific duty laid down in unit Standing Orders.

The estimation of altitude is usually less important, but if one is training in a mountainous region it is not only of general interest but it is necessary

if one wants to forecast with any accuracy how long a march involving a certain amount of climbing will take. In teaching men to judge heights by visual observation it is enough to point out various hills the heights of which can be read from the map. If one wants to observe during training how long it takes them to climb certain heights it is best to check up on the ground with a good aneroid barometer with which one can measure with reasonable accuracy ascents and descents of less than fifty feet which are so common in all hilly country and are not shown on maps with a vertical interval of fifty feet. It will be found useful, when teaching the representation of altitude on maps, to make men learn how to layer tint the map. If a number of men can perform this simple but time-consuming task neatly and accurately all the maps issued to the unit for a battle can quickly be layer tinted if the C.O. wants this to be done.

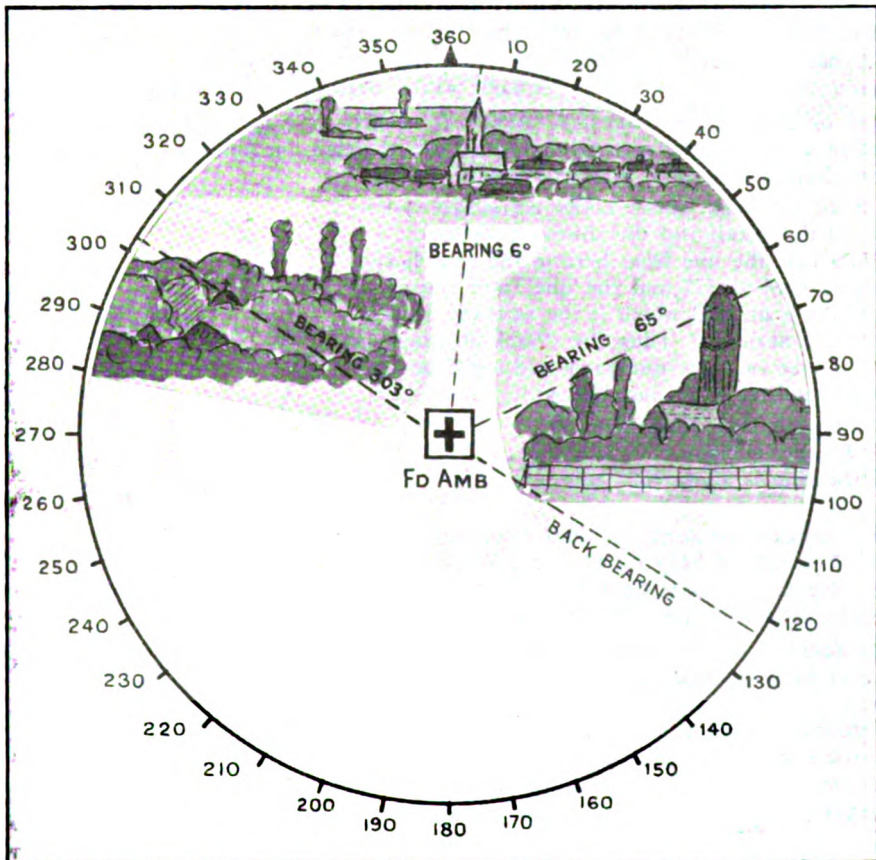
When the heights of the hills in the training area are known section officers and N.C.O.s should study how long their men take to climb to various heights when lightly and when heavily loaded. As they will at the same time be learning to estimate heights and to select the best route up a hill by preliminary visual reconnaissance they should finally be able to judge how long a task should take. Fit, mountain-trained, and acclimatized men should be able to do about a thousand feet in half an hour in most hills, if not heavily laden. It has been said that in mountains every pound over forty-five weighs two pounds. In general it is best to let men take their own pace up a hill, and those whose natural pace is fast can wait for the slower ones just below the summit—not actually on it if they have been sweating, because of the danger of getting chilled.

Navigation in deserts and in mountains, especially in conditions of low visibility such as mountain mists or at night, is intricate and interesting, and requires study and practice. In desert warfare conditions as many men as possible should understand the principles of Field Navigation, and a reasonable number must be highly trained in it. Maps are often inaccurate in the desert and if one is following what one believes to be a track shown on the map without keeping a careful check on one's direction one may get into serious trouble. Columns of vehicles may make tracks which are better defined than the one shown on the map, and though at first they may seem to be going in the right direction they may lead one astray. A constant error of 5° in bearing causes a deviation from the course of 150 yards in a mile, and as the point in the desert for which one is aiming may be very small and inconspicuous it is easy to see how important it is to keep on the proper bearing. The leader of a column in the desert can only be free to lead the vehicles across country, picking the route according to the "going" and perhaps also to tactical considerations, if he knows that a competent navigator is keeping a careful check on his position by means of a properly kept navigator's log. The same method can be used when navigating vehicle convoys in other types of country, and to keep track of one's position in cross-country marches

on foot in difficult country, in which case instead of the record of milometer readings a record is kept of the times during which the party marches on each successive bearing or average bearing.

When deviation from the chosen route is necessary the basic principle prescribed is that one of the Compass Party of three must always remain stationary on the bearing whilst the other two who go ahead to find a way round the obstacle must cross the line of advance on the other side of it before reaching the limit of visibility.

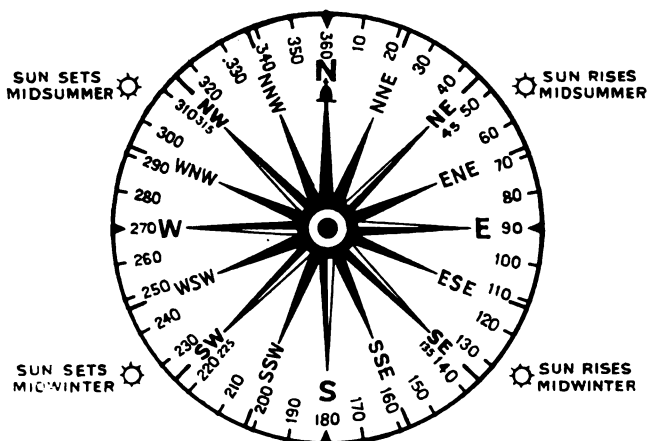
IN STUDYING RESECTION IMAGINE A BIG COMPASS
CARD THROWN OVER THE COUNTRY



Compass Bearings shown on this Chart

Same Bearings converted to Grid Bearings in fig. 1.

Conversion of Bearings—See para. (2) and figs. 2 and 3.



MAP READING INSTRUCTION

- (1) BEARING ... — ANGLE A LINE MAKES WITH NORTH.
 I.E. GRID BEARING — ANGLE A LINE MAKES WITH GRID NORTH.
 MAGNETIC ... — ANGLE A LINE MAKES WITH MAGNETIC NORTH.

BEARING OF DUCY STE MARGUERITE CHURCH from here:

Draw a line parallel with Grid North Lines through our position on map and then a line from our position to DUCY CHURCH.

THE ANGLE BETWEEN THESE LINES MEASURED CLOCKWISE is the BEARING of the church from here.

Note that the line from here to the church cuts compass card at 57° and the line from church to here cuts it at 237° which is the REVERSE BEARING or "BACK BEARING." Thus the "Back Bearing" is what a man on DUCY CHURCH would see if he took a compass bearing on our Camp.

RULE to calculate Back Bearing:

If Bearing is below 180° add 180°.

If Bearing is above 180° subtract 180°.

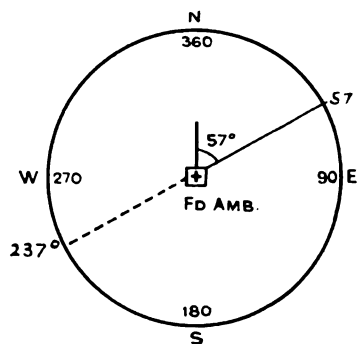


FIG. 1.

- (2) TO CONVERT MAGNETIC TO GRID BEARINGS.

Look at side of Map for Compass Variation and the information about Grid North. On this map the Magnetic Variation is 9° 50' (approx.) WEST and GRID NORTH is about 2° WEST OF TRUE NORTH. (Note date of map—annual variation etc.). For our purpose it is accurate enough to say that MAG NORTH is 8° WEST OF GRID NORTH. As GRID NORTH is 8° EAST OF MAG NORTH and as ALL BEARINGS are MEASURED CLOCKWISE the Grid Bearing on this sheet is always 8° LESS than the MAGNETIC BEARING.

To convert Compass Bearing to Grid Bearing subtract 8°.

To convert Grid Bearing to Compass Bearing add 8°.

NOTES.—(i) No notice has been taken of individual variations in different compasses.

(ii) Remember the GRID is just a system of squares put on the map for the convenience of map readers.

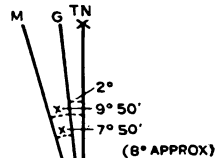


FIG. 2.

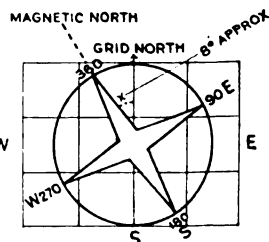


FIG 3

(3) TO FIND YOUR POSITION BY RESECTION.

- (i) Take MAGNETIC BEARINGS ON THREE PLACES.
- (ii) Calculate BACK BEARINGS from these places and CONVERT THESE TO GRID BEARINGS.
- (iii) Draw these on the map—e.g. lines through the places parallel with GRID NORTH—mark off the bearings with protractor—draw lines from the three places along the bearings—WHERE THESE THREE LINES INTERSECT IS YOUR POSITION.

(4) PRACTICE IN ABOVE METHODS.

- (i) Find position from bearings on CHURCHES AT CONDES SUR SEULLES, CONCAGNY, and DUCY STE MARGUERITE. Check with bearing on CHATEAU.
- (ii) Identify Spires of BAYEAUX, and Dome of Church at 797919 by noting GRID BEARINGS, converting to MAGNETIC BEARINGS, and then using Compass and BINOCULARS.
- (iii) Plot on map position of crashed aircraft West of Camp—by taking Compass bearing converting to GRID BEARING, ESTIMATING DISTANCE, noting contours on map, etc., as a check.
- (iv) Devise other tests of map reading—e.g. line of R. SEULLES, of Railway, direction of Enemy positions, etc.

SECTION OFFICERS will ensure that ALL RANKS understand these points—because even if resection is not often necessary it helps you to understand map reading and, POINTS OF THE COMPASS about which too many are still very uncertain.

RESECTION WITHOUT A COMPASS will also be practised—using talc or tracing paper—this is not an accurate method.

(To be continued)

THE SYMPTOMLESS TRANSIENT URINARY CARRIER OF ENTERIC ORGANISMS AMONG EGYPTIANS

BY

Lieutenant-Colonel H. C. M. WALTON

Royal Army Medical Corps

THE purpose of this paper is to draw attention to the fact that in a population, such as that of Egypt, relatively immune to the enteric fevers in adult life, a symptomless transient carrier state is not uncommon. It has been found that the organisms are almost always excreted in the urine.

At the Central Pathology Laboratory routine bacteriological examinations of urine are carried out on Egyptian and Sudanese food handlers working in the Fayid area. These are almost all men between fifteen and forty years of age. Three examinations of urine are done, usually before employment. If these are negative the man is allowed to handle food.

The number of examinations in 1948 was:

<i>Men examined</i>	<i>No. of specimens of urine</i>	<i>Positive cases</i>
3,464	10,238	<i>S. typhi</i> 3
		<i>S. para A</i> 12
		<i>S. para C</i> 4
	<i>No. of specimens of faeces or rectal swabs</i>	<i>Positive case</i>
	1,603	<i>S. typhi</i> 1
		(From a urinary carrier of <i>S. typhi</i>)

The numbers of examinations done at the Central Pathology Laboratory by months are shown in Table I.

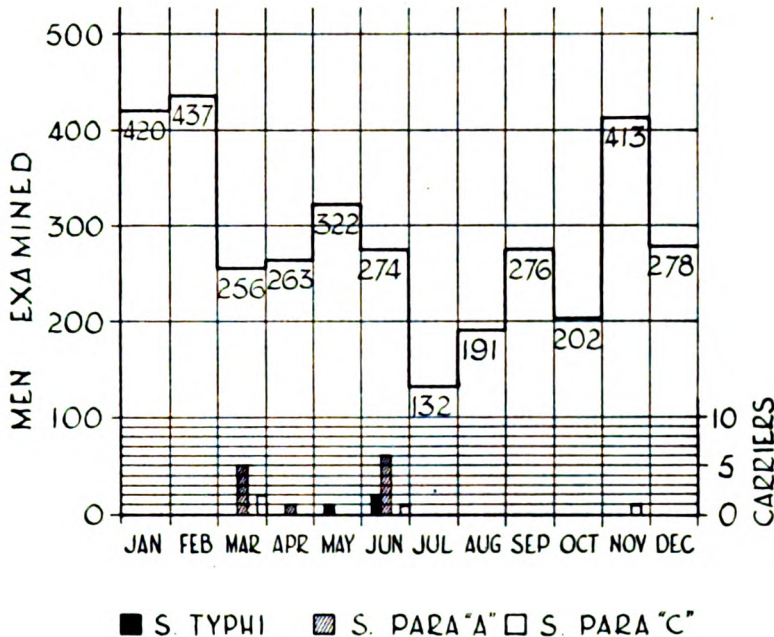
The technique of pooling devised by Ashton (described in the appendix of the seventh meeting of the subcommittee of immunology) was used until March, when carriers began to be found.

As all the original specimen was used in the pooling, it was necessary to obtain fresh specimens whenever a batch was found to contain enteric organisms.

The present technique of isolation is to pool the urine taken from one man on three successive days.

The pooled urine is put into an equal quantity of tetrathionate broth (i.e. about 60 c.c. of urine into 60 c.c. of broth) and incubated for from eighteen to twenty-four hours. A loopful is then plated on desoxycholate citrate agar (D.C.A.) and incubated for twenty-four hours. An alternative and equally successful method is to incubate the tetrathionate broth for from six to eight hours, subculture on Wilsons-Blair's Bismuth Sulphite medium and incubate

TABLE I.—1948. FOOD HANDLERS EXAMINED BY MONTHS WITH NUMBERS OF POSITIVE RESULTS



for from forty-eight to seventy-two hours. (Selenite F was not available in sufficient quantity for routine use.)

During the months of March to July a mobile bacteriological laboratory was working at first in Moascar near Ismailia, later near Fayid. Captain M. G. McEntegart was in charge in March and April and Captain A. D. Bangham from April to July.

Its work consisted of the following examinations:

No. of men examined	No. of urines	No. of positives
270	1,255	24 <i>S. typhi</i>
		15 <i>S. para C</i>
No. of faeces	No. of rectal swabs	No. of positive
166	841	Nil

Of the 270 men, 190 were found negative on the first three tests and not re-examined. 88 men were examined more than three times, as indicated in incidents 3 and 4.

The positive findings represented 14 individuals, 8 of whom excreted *S. typhi*, and 6 *S. paratyphi C*. The details are given in the third and fourth incidents.

A large proportion of the carriers detected were found working together. They are described below in four incidents.

First Incident.—The first incident in which the presence of transient carriers

was clearly indicated occurred at the time of the changeover of the staff of the static bakery, Fayid, from German P.o.W.s to Egyptians. No cases of enteric fever occurred in the British Troops attached to the Bakery, nor were any cases traced to the Bakery. One hundred and six Egyptian bakers were brought down to Fayid from Cairo. The urines were collected on March 11, 13 and 15 in batches of 20, and the odd 6 put in a separate batch. These batches were pooled for examination.

Two of the batches of 20 and the batch of 6 showed no enteric organisms. One batch grew *S. paratyphi A*. Two batches grew *S. paratyphi C*. This entailed individual examination of 60 urines. Specimens of fæces were also collected from these men. These were collected about April 9. *S. paratyphi A* was isolated from the urine of 1 Egyptian (3 subsequent examinations of urine and rectal swabs from this man completed on June 2 showed no enteric organisms). *S. paratyphi C* was isolated from the fæces of one man on March 17 (3 subsequent tests of urine and fæces completed on April 19 were negative). The details are shown in Table II.

TABLE II																
<i>S. para A and S. para C Bakery</i>																
Day	1	3	5	7	10	20	30	39	40	41	50	60	70	80	81	82
Carrier 1 P							X							O	O	O
<i>S. para A</i>																
Carrier 2 P				X				O	O	O						
<i>S. para C</i>																

P=Positive in pooled urine; X=Positive; O=Negative.

This incident suggested that the transient carrier state may be common among Egyptians living in cities.

There is additional evidence for this in the third and fourth incidents.

Second Incident.—The only incident where the discovery of carriers among Egyptians was related to a case of enteric fever in a British soldier was in a Tank Regiment in Shandur. A trooper was taken ill with typhoid fever at the beginning of February. There were no other cases in the unit at that time and there was nothing to suggest that the man had contracted the disease at Shandur.

On February 27 *S. paratyphi A* was isolated from the pooled urine of 9 Egyptians employed in and around the cookhouse. During subsequent investigations *S. paratyphi A* was isolated from 3 men on one occasion each and from one man on two occasions. This man was unfortunately dismissed from employment before further specimens could be taken.

On April 7 (day 42) *S. paratyphi A* was isolated from the blood of one trooper of this regiment. No other cases occurred. Specimens of urine and fæces taken on April 19, 21 and 23 from the eight remaining Egyptians were negative. The details are given in Table III.

It will be seen that if the search for carriers had started when the case of paratyphoid fever occurred, no carriers would have been found.

Third Incident.—The most striking incident was recorded by Captain M. G.

TABLE III

<i>S. para A</i>										<i>R.T.R. Shandur</i>									
Day	1	5	10	14	15	20	25	30	35	40	42	45	50	54	56	58	60		
Carrier	3	P		X					X	Dis-									
	4	P		X					—					O	O	O			
	5	P		—					X					O	O	O			
	6	P		—					X					O	O	O			

P=Isolation from pooled urine; X=Positive; O=Negative; —=Not examined.

Day 1 is February 27. Day 42 is April 7.

McEntegart and later Captain A. D. Bangham using the mobile bacteriological laboratory.

The unit was at Moascar. No cases of enteric fever occurred in this unit in 1948. About 80 Egyptians are employed.

The investigation was started on March 21. Of the first 26 Egyptians examined, 6 were found to be excreting *S. typhi* in their urine. One man (No. 7) who at the start of the investigations was a cook in the officers' mess, is likely to be a chronic carrier. *S. typhi* was isolated from his urine on 9 occasions between March 21 and May 30. On May 4 his *S. typhi Vi* titre was $\frac{1}{40}$.

No. 8 may also be a chronic carrier. On May 4 his *S. typhi Vi* titre was $\frac{1}{20}$.

Others carried for varying periods. The positive results are given in Table IV.

TABLE IV

		<i>S. typhi</i>																			<i>Mobile Lab.</i>				
Day		1	3	8	9	12	13	14	15	16	22	25	28	36	43	50	57	64	71	72	73	Day			
Carrier	7	X		X					X		X		-	X	X	X	O	X	X			7			
	8	O		X				O			X		X	X	X	-	-	-	-			8			
	9	-	O	X		O			X		O		-	X	O	O		O	O	O	O	9			
	10	O		O				X			O	-	-	X	O	O	O	O	O	O	O	10			
	11	-		X			O			O	X	O	O	O	O	O		O	O	O	O	11			
	12	-		O	O		-			-	O		-	-	X	O	O	O	O	O	O	12			
	13	-		-			-			-	-		X	X		O						13			
	14	O		X				O			O		-	O								14			
	15	O		X					O		O		-	O								15			

X = Positive; O = Negative; — = Not examined

Day 1 is March 21st, 1948

Day 71 is May 30th, 1948

A total of 40 men were examined in this group. Those found negative were repeatedly examined at the same time as those found positive.

All the *S. typhi* were phage type G. On first isolation many of the organisms were found to be rough, and some difficulty was experienced in making them typable.

Fourth Incident.—In May and early June other Egyptians of a unit at Moascar were found carrying *S. paratyphi C* in their urine. A total of 40 men

were examined in this group. Those found negative were examined at the same time as those found positive. Only the positive results are shown in fig. 5.

The first isolation of *S. paratyphi C* was on May 2 when three Egyptians were found to be carriers.

It was isolated from one man (No. 16) on all five occasions when he was examined between May 2 and 30.

It is possible he is a chronic carrier.

The details are given in Table V.

		<i>Para. C</i>				<i>Mobile Laboratory</i>					
	<i>Day</i>	1	8	15	22	23	28	29	30	31	32
Carrier	16	X	X	X	X			X			
	17	O	X	O	X			X			
	18	—	X	O	O	O	X	X			
	19	X	O	O	O			O		X	O
	20	X	O	O	O			O		O	
	21	X	O	O	O			O	O	O	

X=Positive; O=Negative; —=Not examined. Day 1 is May 2, 1948.

It is unfortunate that it was not possible to continue this series of observations longer, as it may be that carriers 17, 18 and 19 were transient carriers infected from Case 16 on two occasions, or they may have been intermittent carriers.

Carriers 20 and 21 were evidently transient carriers.

DISCUSSION

In trying to find out the cause of epidemics of enteric fever, a great deal of time has been taken up in examining food handlers to find a carrier. The work done in this laboratory so far, suggests that the value of this is limited.

In the second incident no carrier at all might have been found, if the investigation had started when a case of paratyphoid A fever was diagnosed.

It is evident from these incidents that very few cases of enteric fever will occur if the hygiene is satisfactory.

From the point of view of statistics, it is evident that the term "carrier rate" has very little meaning unless sufficient examinations are carried out to distinguish the transient from the chronic carrier.

It was remarkable that no carriers were found among the Egyptian food handlers in units where two or more cases of enteric fever occurred.

On three occasions between June and December, outbreaks of enteric fever occurred in British Army Units. The numbers of cases were four, two and five.

In spite of repeated examinations of urine and rectal swabs, no carrier was found among the British cooks or Egyptian food handlers.

These facts suggest that the disease is spread by transient carriers who have stopped excreting the organism by the time the outbreak of disease occurs.

or that the disease is spread by the excreta of undiscovered carriers outside the units.

Work is continuing at the Central Pathology Laboratory to find out whether such carriers are in fact transient or intermittent chronic carriers and also to ascertain what other factors affect the chronicity of carriers such as age, infection of the urinary tract and schistosomiasis.

I wish to thank Colonel W. F. Lane for his encouragement to write this paper, Colonel G. T. L. Archer, D.D.P., M.E.L.F., for his helpful criticism, Captain J. M. Dunbar for carrying out the phage typing, Captains M. G. McEntegart and A. D. Bangham for the use of their records and Major-General T. Menzies, D.M.S., M.E.L.F., for permission to forward this paper for publication.

THE DENTAL SERVICE IN SOUTH-EAST ASIA¹

BY

Lieutenant-Colonel D. V. MUIL

I APPROACH my subject with much diffidence, partly because it follows a series of vastly interesting talks and discussions, and partly because while dental matters are very akin to yours, there must be many aspects of the subject that can only be of concern to dentists themselves. We have our own many problems, but I would hesitate to inflict them upon you today. Besides, this subject is not a very broad one and I should like to generalize to some extent.

It will be best perhaps if I first outlined the dental organization as it existed in South-East Asia; as it was at the end of 1942 in Bengal and Assam, then in Burma, Malaya and the other scattered places. We had to depend almost altogether on dental units raised in India from British and Indian personnel. We had to rely on what India could raise and what they could spare. It was much later in the war before anything like a respectable dental cover was achieved. Indeed, Field Dental Centres were on their way out from home when the Japs collapsed. These units, of course, had been very usefully employed elsewhere.

The units raised in India were, first, the Indian Dental Unit (British troops), consisting of a British dental officer, a British dental operating room assistant and four Indian other ranks. Second, there was the Indian Dental Unit (Indian troops) with an Indian dental officer, and five Indian other ranks. The former was primarily intended for the treatment of British troops, and the other, of course, for the Indian troops. But both types of unit were so few that it was only possible in one or two of the larger centres to have a unit of each kind. Usually, the units treated both Indian and British troops and quite satisfactorily.

For the carrying out of denture work there was a third and strange little unit called the Indian Dental Mechanic Unit having a British dental technician and two Indian other ranks. An unnecessary unit, I think. It would have served had the technician been part of the I.D.U. (B.T.) with which unit he usually worked anyhow. He could have been detached for duty with the Indian troops unit if it was ever necessary. The Indian troops were not in the ordinary way provided with dentures. They rarely needed them, naturally, because their dental standard on enlistment was high. You will remember that there was no dental standard on enlistment for our own troops.

These I.D.U.s on the whole, did very good work indeed. It should be pointed out that the Indian dental officer in most cases was a young man fresh from hospital, and from an environment very different from our own, who

¹A Paper read at "Exercise Bamboo."

was given at Poona, an equipment, tentage, five other ranks, very little training and was sent some hundreds of miles eastwards to fend very largely for himself. Most of them did excellently.

Our units were independent—they must be so—and yet they were usually attached to medical units. Then they accepted many privileges and, rightly, some responsibilities too. But I am grateful for the kindness and help that our units received from officers commanding medical units. These friendly, helpful relationships between units are vital for the well being of the smaller units such as ours mostly are in the Field.

At the end of 1942 there were very few dental officers, British or Indian, in Bengal and Assam. G.H.Q. (India) would not allow dental officers to come forward unless they were part of a unit, and a unit that was complete in every detail. We should have been glad even to have had dental officers equipped only with a haversack of instruments. The odd units that we had in Manipur Road, Imphal and Chittagong were overwhelmed. Troops were trailing back the three hundred miles to Calcutta to have dentures repaired and replaced. But perhaps that was a sample of much that existed in the early days after the Japs had swept up through Burma.

These I.D.U.'s had one pronounced disadvantage; they had no transport of their own. Certainly, a few of them did become more or less static, but the movement of the others down the long road to Rangoon was often a problem. The lack interfered with their efficiency for they were not able to get round and take treatment to the units. Transport was scarce and it was hardly fair always to expect the medical unit to which our unit happened at the time to be attached to do the moving. That they moved at all was often solely due to the energetic A.D.D.S. who found a three-ton lorry somewhere and this he drove up and down the road, in it moving his units southwards. Field dental units must have their own transport if they are to do their jobs.

It was later that we got one or two British medical units with dental personnel on their establishment. The African divisions had dental personnel too, with their medical units, and since there are African troops in "Bamboo," I would say, briefly that they, like the Indians, had generally little in the way of dental cases but there was often considerable gingivitis in one form or another.

There were in India two Indian maxillo-facial surgical units, each with two British specialist dental officers, and these did very valuable work. One was stationed in Calcutta for some time but was moved out eventually as it was considered that the local humidity was not good for their particular long-term work. You have heard how slow and difficult was medical evacuation from the Arakan. Later, when air evacuation became possible the maxillo-facial unit in Calcutta was receiving its cases within six or seven hours of the casualty. It is to be hoped that these often pitiful cases can be got back always as early as possible. So far as administration was concerned, at the end of 1942, there was an A.D.D.S. at H.Q., Eastern Army. When 11 Army Group

was formed and that afterwards to become A.L.F.S.E.A., there was a D.D.D.S., and two or three A.D.sD.S. according to the changing needs and changing formations.

I don't think that the difficulties generally of a dental unit in the Far East and in jungle conditions greatly vary from those in the Field elsewhere. The difficulties, such as they are, will be common to most units there. One of the main ones perhaps may be the restriction on movement. We might have to rely on jeeps and trailers, or on pack mules, or have to do our best with something we can carry round ourselves. In another theatre we might have the great advantage of using our fitted prime movers, most usefully equipped vehicles. But we have to adapt our equipment and its containers. For example, one of the I.D.U.s, with some surgery and workshop equipment, did two or three trips from Calcutta to Chungking, a rather bumpy bit of airlift over the Hump to China, and there was an Indian dental officer, with two Indian other ranks, who with an equipment of sorts and their gear on mules, went for a five days' trek to treat some isolated posts in the jungle. All rather fun, but I remember that this dental officer, on the way back was nudged off a narrow track and down the Khudside by one of the mules to break an arm and, rather disgracefully, to lose a couple of his front teeth. We can, then, adjust our unit and equipment to the need, and some adjustments will be necessary in "Bamboo."

Our I.D.U.s were provided with tentage, but it was found that the smallish sixty-pound tent with its pole well propped up on an oil drum to give extra head room, and with a length of canvas draped round below the raised sides made very satisfactory accommodation for surgery and workshop. A curtain of butter muslin, or something of the sort, hung loosely over the open end of the tent facing the chair, kept out some of the dust and flies, but not all the light and, I hope, the air. The "basha" made of reeds and bamboo with its brick or earthen floor was excellent when conditions were more stable.

There have been few changes in the dental organization since the war. It can be said, I think, that the mainstay of our Corps in the field is the Mobile dental team. It was known as the mobile dental unit. It carries an officer, a D.O.R.A., a dental technician and, also, an R.A.S.C., driver of the vehicle. This unit can get about and go where it is needed. Some of the allotted number should be used well forward; I would emphasize that, for they are going to prevent dental sick wastage from the forward area, and having a dental technician, they are going to prevent men having to go back—and some few may wish to get back—to have dentures replaced and repaired.

The allotment of mobile dental teams is one per armoured division, two per infantry division, three per corps, plus increment of one per division or its equivalent within the Corps. That is to say, an Army of two Corps each having one armoured division and two infantry divisions would have twenty-two M.D.T.s. The balance of the cover would be provided by other types of unit and by dental officers and technicians carried on medical establishments.

Important, too, are the Field dental centres with one to four dental officers and the Field dental laboratories who do the denture work for the centres. But these units are for the base and the L. of C. The Field Ambulance has its dental officer and now, also, its dental technician. I think that the 1946 Standardization Committee decided that the dental personnel and their vehicle should form a dental section of the Field Ambulance. It will be agreed, I think, that this dental officer, has usually proved himself very useful in many ways. It might be said, purely from our own point of view, that he has divided interests. He does, however, help to meet the dental need forward.

The C.C.S. has its dental officer, and two technicians. With the general hospital is a graded or specialist dental officer and one or more technicians according to the size of the hospital.

The overall dental cover during the war was one dental officer to 1,500 and one technician to 2,000. But the actual cover in the Field varied somewhat.

The Field dental outfit—surgery and workshop—weighs about 11 cwts. This with the three bodies, leaving out the driver, and with their tentage, etc., is a lot for a jeep and trailer, which I understand, carries 15 cwts. So in “Bamboo” some adjustments will have to be made.

When the standardization of equipment is considered, it may be that we shall get a lighter and more convenient Field outfit. That is not necessarily a criticism of our present outfit, for it has served us well; but we are always progressing. We have so many odd bits and pieces to carry around that the shape, as it were, of our Field outfit is of very much importance to us.

I don't think that the supply of stores ever worries us very much.

There is no doubt that experience in S.E.A.C., and elsewhere, has shown the great value of dental units getting forward, or ashore, reasonably soon. I say, reasonably soon, for I know that everyone tries to get his units in early, and there are essentials. The D.D.M.S., 15 Corps, has said that, during the Arakan operations, he was surprised by the large number of enquiries for dental treatment he had from all and sundry soon after landing. These came from our own men, from the small naval and R.A.F. units taking part, from civil liaison people and so on.

You may not have heard this story told by Lord Louis Mountbatten. He tells how he and Mr. Churchill were present at one of the very first combined operations exercises, and they were watching one or two planes dropping supplies to the supposedly hard-pressed troops who had just landed on the beach. It was Mr. Churchill who led the way over to the first package to reach the ground and said, “Let's have a look at this.” When it was opened—you can guess, no doubt—it contained a Field dental chair. Lord Louis says that on one or two subsequent occasions when he and the then Prime Minister were discussing combined ops., Mr. Churchill said, “Now, for goodness' sake, don't forget the dental chair.”

But, quite seriously, some dental personnel should, if possible, be phased

in early, and that first expert aid that they can provide for maxillo-facial cases before evacuation may make all the difference to the later work of the maxillo-facial team.

Meanwhile, of course, all the other units of ours are doing their job at base and in the L. of C areas. The routine treatment is never, never all completed, I'm afraid. We should always hope to make the majority of men dentally fit before setting out on an operation of this kind. That would always be our aim. But having managed that very tall order, we cannot guarantee that they will all stay fit for the necessary time. Even under the best of conditions you must always insure against the unpredictable dental emergency cases. In dentistry we still have so very much to do.

There was the very important personage in South-East Asia who said, "We had no dental services before the 1914-18 war and we managed." There is, of course, a very telling reply to that remark. There is the price of so-called progress. But it is a chastening remark and perhaps it helps us to keep our job in its proper perspective. Yet, I suppose, unless we are quite confident—as we are—that our job is every bit as important as the next man's, we cannot really be doing our best in the scheme of things.

Clinical and Other Notes

MEDICAL RECORDS IN THE ARMY

BY

W. E. CONWAY

Registrar

(Continued from page 222)

THE UNIT MEDICAL RECORDS SYSTEM

Sir Hugh Cairn's excellent and able Address should leave no doubt in our minds as to what the purpose and uses of Hospital Medical Records should be. A study of Chart "A" might further stimulate interest in the rôle which medical records play in the general set-up of modern medical administration.

In military medical circles I feel there is need for some concentration of effort to improve medical records. In my experience a patient's dossier consists for the most part of an untidy and sometimes inconclusive record of his stay in hospital and of treatment given as an out-patient. This is a great pity, for almost invariably the medical case notes themselves are, to my mind, of very high quality, written clearly, concisely and yet with a vast amount of detail. Time and time again I have seen a ministerial or other enquiry adequately dealt with solely on the merits of these notes.

I do hope I have not conveyed the impression that military medical records are in all cases so much behind those in civil hospitals. I am led to believe that in those latter hospitals where the matter is not regarded seriously their records are in fact not equal to ours. The difference rests in the fact that on the whole, the civilian hospitals management committees recognize the importance of having a high standard of medical records upon which so much depends for the efficient administration of a hospital.

These departments are placed in the charge of specially trained staff and experienced staff, but, even so, improvements could not be undertaken without some increase in hospital expenditure. An illustration of what has been accomplished in this direction may be seen in the Medical Records Department of the Royal Hampshire County Hospital, Winchester.

The basic principle of Medical Records is the "Unit Medical Records System."

This in brief comprises the following:

(i) All notes on an individual patient, however widely separated in time, and however many departments (in-patient and out-patient) have rendered service to him, are kept in one folder. In order to allow for the variations in thickness of the notes of different patients, the folders should be of the

two-boards-with-fastener type. ("Casualty" notes, which are of doubtful value, need not be included if not required for further reference.)

(ii) The notes for each term of treatment appear in a prescribed order, e.g. front sheet, Registrar's summary, progress notes, medication and diet records, pathological reports, X-ray reports, other special reports, social service report, photographs, post-mortem report, correspondence. Simple forms (holed for binding) for each purpose are used.

(iii) All notes are on standard-size stationery (approximately quarto) smaller documents being mounted (in series if there are more than one kind) on sheets of standard size.

(iv) Each sheet contains the basic identification data on the patient to ensure that misfiling risks are minimal.

(v) A single numbering system is employed; the patient retains the number allotted to him throughout his connexion with the hospital.

(vi) A master alphabetical name index of patients is the key to the numerically filed notes.

(vii) A diagnostic index is maintained, so that all notes of patients treated for each disease can be rapidly isolated for medical, administrative or research purposes.

(viii) Records are controlled, from initial registration to final disposal, by the hospital medical records officer, and are issued to and withdrawn from wards, clinics and departments as required, always returning to the central filing system. Notes are not handled by patients. An efficient appointments system for all out-patients is required. The records department should control the registration office, appointments bureau, medical and secretarial staff and the indexing, filing and statistical clerks, and should hold the in-patient waiting lists.

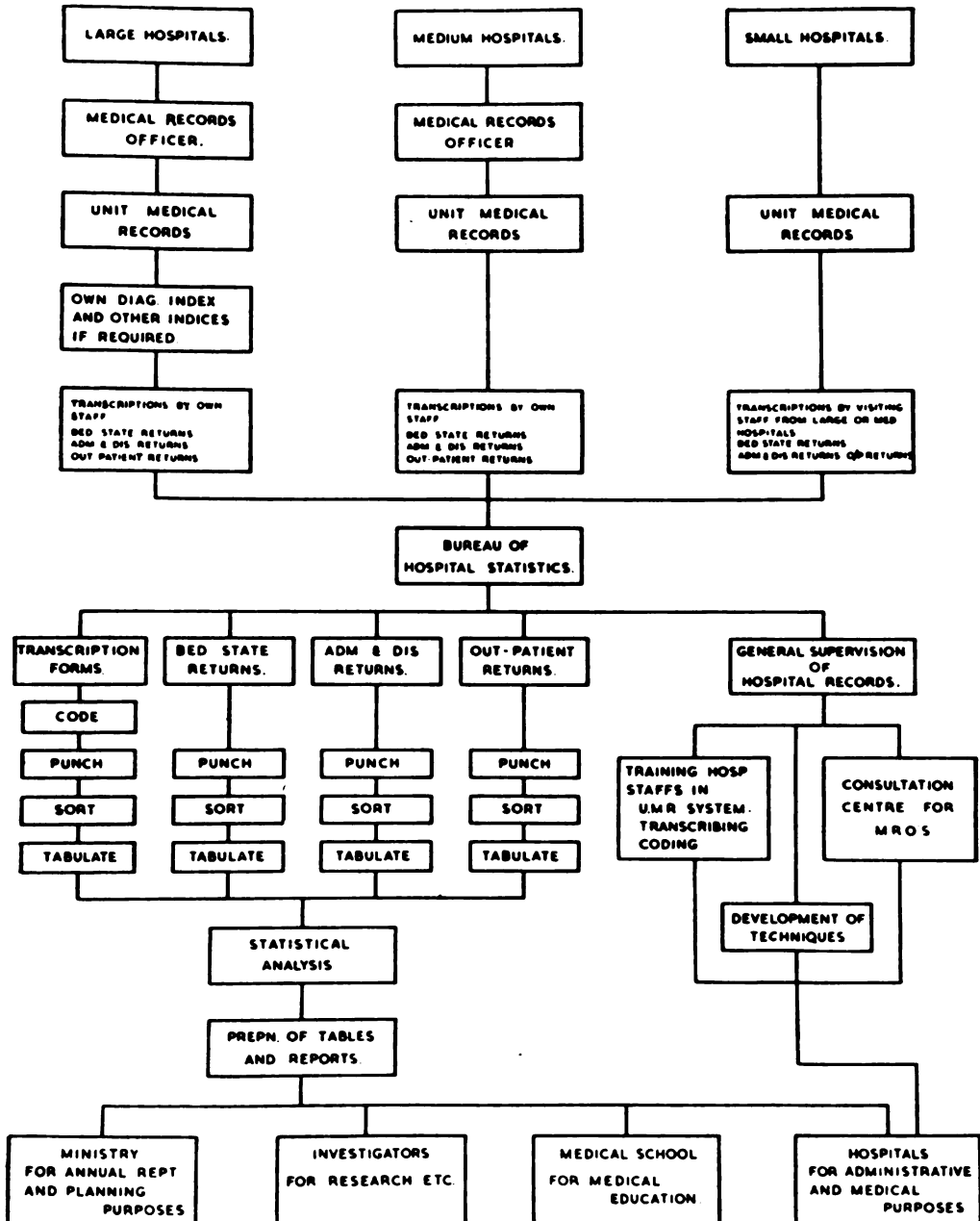
The unit medical record requires some consideration apart from medical records as a whole for it is much more than an improved filing system of a patient's papers. Its necessity would probably never have arisen but for the growth of specialized medicine and of hospitalization, for while the G.P. was able to attend to all, or most, of his patients' needs, the problem did not exist.

The unit medical record has developed as the means of correlating the findings of a given patient, made at different times and by different specialists usually in the same hospital.

The purpose of a unit medical record is not accomplished merely by correlating in a single folder all the data on one patient. Details must be so arranged and prepared so that one may quickly find any particular paper or note among all the others. The general aspect of the case should be available at once without the necessity of search.

The basic arrangement of papers is chronological. The grouping of notes of each type such as laboratory reports and so on seems to destroy as it were the narrative of the case, however convenient it may be to follow progress in

AREA OR REGIONAL HOSPITAL RECORDS AND STATISTICS



a given line of treatment. In some cases there are very good reasons to depart from this rule but these are the exception.

Because, no doubt, of the special functions of the Military Hospital for Head Injuries, frequent demands are made to furnish files on patients and many hours are spent to make the files presentable before despatch. As most of the cases have been long-term patients it has been found possible only to arrange their papers in departmental order, such as laboratory reports, X-ray reports, and so on. In one case it took a senior clerk five hours to arrange the papers in this manner.

At this stage someone might argue, where does all this get us? We have managed so well in the past, let us carry on as we have done previously. I really think that if such a person once saw a properly presented medical record this viewpoint would disappear.

(To be continued)

Obituary

Lieut.-Colonel AUGUSTINE THOMAS FROST, O.B.E., M.B.

Royal Army Medical Corps

In Reading on June 1, 1949, Lieutenant-Colonel Augustine Thomas Frost, O.B.E., M.B., R.A.M.C., retired.

Born February 28, 1878, he took the M.B. of the Royal University of Ireland in 1902, and entered the R.A.M.C. July 30, 1904.

Promoted Captain January 30, 1908, Major July 1, 1915, and Lieutenant-Colonel April 20, 1928, he retired January 24, 1933. On retirement he took the Retired Pay appointment in Reading, which he held till December 3, 1948.

During the 1914-1918 war, he served in India and Mesopotamia, being brought to the notice for valuable services rendered and also mentioned in despatches and awarded the O.B.E., British War and Victory Medals.

Colonel Frost was a quiet unassuming officer who was liked by everyone with whom he served. He will be remembered by many as a very competent authority on Venereal Diseases and a painstaking teacher.

Lieut.-Col. GODFREY KINDERSLEY MAURICE, D.S.O., M.C.

At Manton Weir, Marlborough, on June 22, 1949, Lieutenant-Colonel Godfrey Kindersley Maurice, D.S.O., M.C. Born in Marlborough, Wilts. January 15, 1887, he was appointed Lieutenant, R.A.M.C., T.A., June 23, 1912, and mobilized August 5, 1914. He was appointed to a regular commission as a Captain June 23, 1920. Promoted Major August 28, 1927, he retired with the rank of Lieutenant-Colonel March 24, 1931.

He was seconded for service with the Egyptian Army March 24, 1921, to January 16, 1925, and to the Sudan Defence Force from January 17, 1925. He became Principal Medical Officer Sudan Defence Force and Assistant Director, Sudan Medical Service in 1928.

He rejoined September 1, 1939, and was released November 3, 1946.

He was the author of "The History of the Sleeping Sickness in the Sudan" and "The Entry of Relapsing Fever into the Sudan." In October, 1939, he contributed a most readable article to Blackwood's Magazine on the fight against sleeping sickness in the Sudan.

He served in France and Belgium from December, 1914 till May, 1919, being mentioned in despatches and awarded the *D.S.O.*, *M.C.*, 1914-15 Star, British War and African Medals.

He served in North Africa from October, 1942 till May 1944, being mentioned in despatches and awarded the African Star.

He was a brother of Colonel George Thelma Kindersley Maurice, *C.M.G.*, *C.B.E.*, late *R.A.M.C.*, who served from 1895 till 1921, and was *J.P.* for Wilts.

Notices

BERTRAND STEWART PRIZE ESSAY COMPETITION

THE subject for the Bertrand Stewart Essay Competition for 1950 is:—
"Surprise is Among the Most Potent Factors in War."

What is the real meaning of this cliché, and to what extent is it true? What is surprise, and how is it brought about? Compare the deliberate efforts to achieve surprise employed by Napoleon, Von Moltke and Montgomery. In what essential did their methods differ and what will be the future trends in the technique in achieving military surprise.

Review

OPERATIVE SURGERY. By Frederick C. Hill, B.A., M.S.Surg., M.D., Associate Professor of Surgery, The Creighton University School of Medicine, Omaha, Nebraska. Oxford University Press 1949. Printed in the United States of America. Price 63s.

This work of close on 700 pages is a most attractively produced compact volume on general surgery. The operative procedures described are those which from his own experience, the author recommends. The book is intended for the student and junior surgeon and covers the whole field including gynaecological and some orthopaedic surgery and only the more special

specialities are excluded. The subject is approached in a way that British text-books might well follow—it commences by describing the hand signals by the surgeon to his assistant for instruments, ligatures, sutures. It goes on to teach suturing and knotting—one handed, two handed, or with instruments. The advice throughout the volume is essentially practical and the illustrations are profuse and, step by step, teach the operative technique in the way that one expects of American illustrations and diagrams.

It is very unfortunate that dollars are scarce.

D. F.

Correspondence

THE following letter of appreciation has been received by the Director-General, Army Medical Services, from Major-General D. R. Thapar, *C.I.E.*, *O.B.E.*, Deputy Director of Medical Services, Southern Army, India. Major-General Thapar during his stay in Europe visited a number of military medical installations in both the United Kingdom and Germany.

"MY DEAR GENERAL,

Before I leave England, I would like to express my most grateful thanks for your courtesy and hospitality during my stay in this country.

It was very nice of you indeed to have made all arrangements for the quick visits to your most instructive Institutions. To say the least, I have learned a lot and hope that I shall be carrying back my impressions and represent them successfully to my Director-General.

I hope there will be more and more co-ordination between our sister services to the mutual benefit of the Medical Services.

With kindest regards."

Yours sincerely,
(Sd.) D. R. THAPAR.

Extracts from the "London Gazette"

(1) HONOURS AND AWARDS

(a) *R.A.M.C. and R.A.D.C. (T.A.)*

The King has been graciously pleased to confer "The Efficiency Decoration" upon the following officers of the Territorial Army:

(i) *Royal Army Medical Corps*

Maj. A. H. Heathcote

Maj. A. H. M. Richards

Maj. J. T. Wybourn

Capt. (Hon. Maj.) J. H. Whittles

Capt. T. R. W. Millar

- (ii) *Royal Army Dental Corps*
Capt. R. E. Buchan

(b) *Territorial Army*

Royal Army Medical Corps

Col. William McKim Herbert McCullagh, *D.S.O., M.C., T.D., F.R.C.P., F.R.C.O.G.*, is appointed Honorary Colonel, 26th July, 1949, a new appointment.

(2) **PROMOTIONS**

R.A.M.C.

(a) To be Maj.-Gen.:

Brig. (T/Maj.-Gen.) T. Menzies, *O.B.E., M.B.* 28.11.49

(b) To be Brigadier:

Col. A. J. Beveridge, *O.B.E., M.C., M.B.* 28.11.49

(c) From *R.A.M.C.* to be Colonels:

Lt.-Col. E. H. Hall, *O.B.E., M.B.* 7.11.49

Lt.-Col. G. A. Walmsley, *O.B.E., M.B.* 28.11.49

(d) To be Lt.-Col.:

Maj. D. Wright, *D.S.O., M.B., F.R.C.S.* 7.11.49

(e) To be Majs.:

Capt. E. M. Ensor 27.9.49

Capt. A. J. Moss-Blundell, *M.B.* 18.10.49

Capt. H. M. Macfie, *M.B.* 8.11.49

Capt. R. G. McFarlane, *M.B.* 29.11.49

(3) **RETIREMENTS**

(a) *R.A.M.C.*

Lt.-Col. J. G. E. Vachell 29.10.49

Capt. H. A. Reid, *M.B.* 29.3.46

Col. F. C. K. Austin, *M.D.* 18.11.49

(b) *R.A.D.C.*

Maj. L. K. Caygill 29.11.49 (Hon. Lt.-Col.)

(4) **APPOINTMENTS TO SHORT SERVICE AND REGULAR COMMISSIONS**

R.A.M.C.

From Short Service Commission to be Capt.:

Capt. D. L. Scott (retaining present seniority) 18.11.49

(5) **RETENTION ON THE ACTIVE LIST SUPERNUMERARY TO ESTABLISHMENT**

Col. B. J. Daunt, *O.B.E.*, having attained the age for retirement, is retained on the Active List, supernumerary to establishment 7.11.49.

EDITORIAL NOTICES

The Editor will be glad to receive original communications upon professional subjects, travel, personal experiences, etc.

Correspondence on matters of interest to the Corps, and articles of a non-scientific character, may be accepted for publication under a *nom de plume*.

All Communications or Articles accepted and published in the "Journal of the Royal Army Medical Corps" will (unless the author notifies at the time of submission that he reserves the copyright of the article to himself) become the property of the Library and Journal Committee who will exercise full copyright powers concerning such Articles.

A free issue of twelve reprints will be made to contributors of Original Communications, and of twelve excerpts in the case of Lectures, Travels, Clinical and Other Notes. Such free reprints or excerpts will, however, owing to the shortage of paper, only be sent to those specifying their wish to have them, and a request for them should accompany the article when submitted for publication, the request being made in the form of a note at the foot of the manuscript.

Reprints or excerpts, additional to the above, can be furnished on payment if specially ordered at the time of submission of the article for publication.

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